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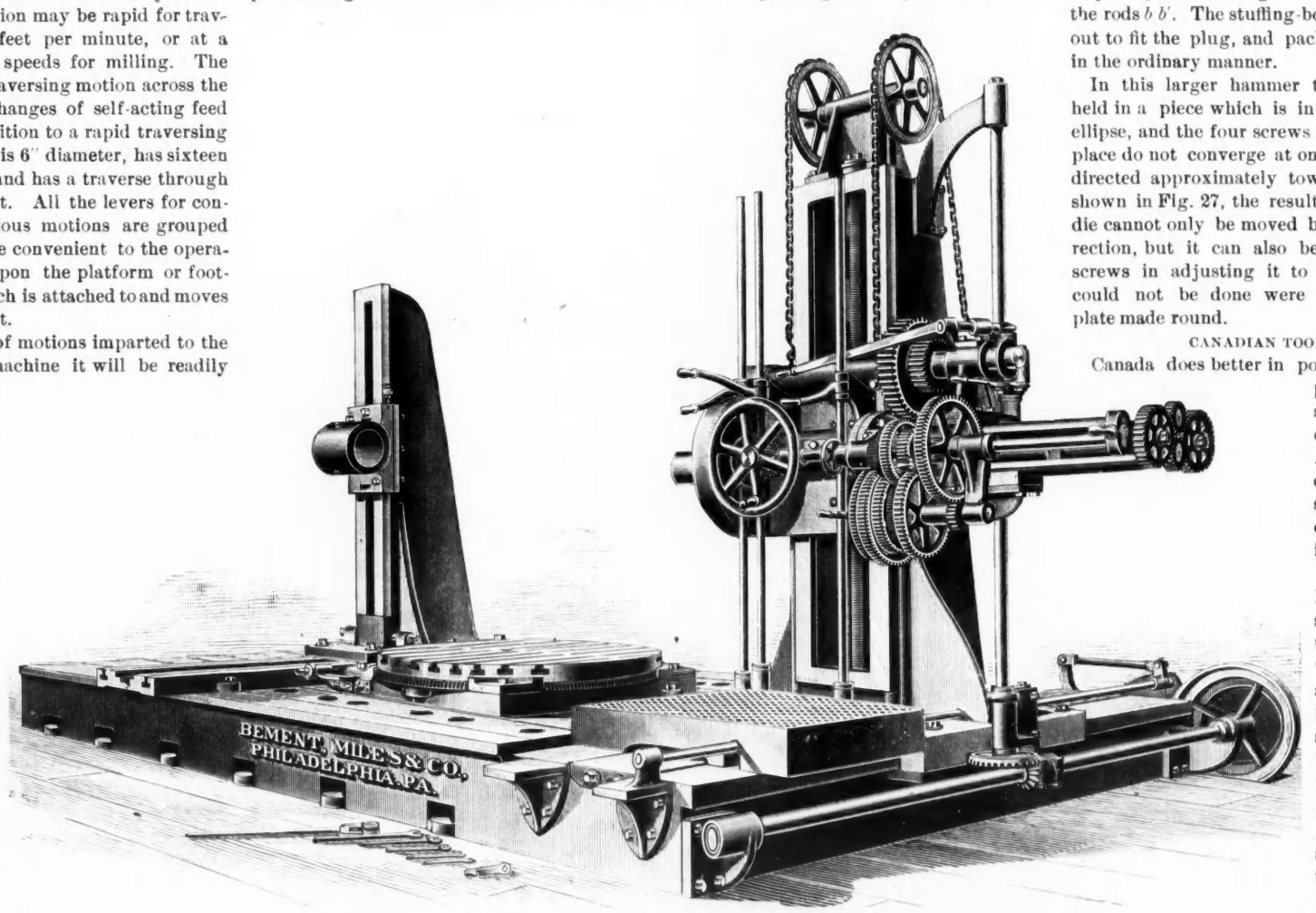
Boring, Drilling and Milling Machine.

We give on this page an illustration of a machine intended mainly for boring, drilling and milling, but so arranged as to be also useful for tapping and stud inserting.

It is constructed either with or without the circular bed, as may be desired, the usual size of the main platen or bed being 10x20 feet. The circular table is 6 feet diameter. The traverse of post is 10 feet. The saddle which carries the main spindle is counterbalanced and may have a vertical traverse upon the post 6, 8 or 10 feet as may be desired, and the motion may be rapid for traversing 15″ to 5 feet per minute, or at a variety of slower speeds for milling. The main post has a traversing motion across the bed with twelve changes of self-acting feed for milling in addition to a rapid traversing motion. Spindle is 6″ diameter, has sixteen changes of speed and has a traverse through the saddle of 4 feet. All the levers for controlling these various motions are grouped together in a place convenient to the operator who stands upon the platform or footboard shown, which is attached to and moves with the main post.

By the variety of motions imparted to the spindle of this machine it will be readily perceived that it is capable of operating upon any part of a heavy piece of work with the minimum of movement of the work during the operations and that the different operations performed upon it will be almost certainly in line and true with each other, while the great range of speeds and feeds, combined with its power and rigidity, enable all the different operations to be done in a very efficient manner.



BORING, DRILLING AND MILLING MACHINE.

It is made by Bement, Miles & Co., Philadelphia, Pa.

Wild locomotives are occasionally known in railroading, but the idea of a cable car running wild for a mile or more through a very busy part of Broadway is something hardly contemplated by the projectors of cable propulsion. Yet that is just what happened lately. The grip wouldn't "let go," so the car kept on gathering in other cars and brushing trucks aside; fortunately no lives were lost. If this were likely to be of common occurrence, it would be bad for cable propulsion, but, as this is not the case, no alarm will be felt, its chief effect probably being the invention of a score or two of "grips" that, in the opinion of the inventors, cannot take the bit in their teeth, so to speak.

Nearly 60,000 pounds of brake shoes are used annually on cars in this country.

Columbian Exhibition Notes—VIII.

Editorial Correspondence.

Though not all there is to be seen here in the way of engines has been presented in this correspondence, most of the more important engines, especially those which possess novel features, have been shown, and it is on some accounts best, probably, that the further consideration of the subject should be deferred for the present, and that of machine tools taken up. The natural place to begin with these seems to be in the foreign sections, though there is precious little in the way of machine tools to be seen there. The exhibit of

BRITISH MACHINE TOOLS,

for instance, consists of two steam hammers, which are built by B. & S. Massey, of Manchester. One of these is rated as 1½ cwt., which means that the weight of the falling parts is 168 pounds; the other is 340 pounds. Besides these there are three small working models of larger hammers, these being driven by compressed air and capable of striking their hardened steel dies together with a rapidity fully equal to the best speed of a sewing machine. The larger hammers are worked by steam, and the man in charge of the exhibit demonstrates his ability to handle them skillfully with the greatest ease. The frames of both hammers are castings with flanges instead of the box form, the reason given for this being that it is easier to detect flaws which may occur in such castings. The smaller hammer is of the overhanging form, the frame being composed of two main pieces, which are bolted to the bed-plate at the bottom, and tied together at the top by extensions from the sides of the cylinder, there being a clear opening between the two sides from the floor line to the cylinder, except for one tie-bar which joins them in front about midway of the slides, which are adjustable and placed on the insides of the two parts of the frame.

The anvil block not only rests upon a separate foundation, but is turned to fit a hole which is bored through the bed-plate, so that as yielding takes place the movement of the lower die shall be exactly vertical, and the two dies thus always kept accurately in line with each other, a large key or feather preventing the block from turning. The construction is shown in Fig. 25, (page 2) which also shows that the anvil block is in two parts, the top part *A* being of steel (casting) and the two dovetails being of the same size, so that by removing the upper block *A*, a much higher die can be put in, or the same dies can be used below, thus admitting work which requires much more room than would otherwise be obtainable under the tup. It also gives a better opportunity than would otherwise be offered for repairs and for truing up the parts by planing. The larger hammer is of the arch form, is adapted for what is called in England "stamping," and here drop forging, as well as for the regular steam hammer work, the change in the valve action for this being very readily made. Since in drop work it is sometimes advisable to shorten the stroke of the hammer and to avoid the use of a full cylinder of steam for these shorter strokes, there is a plug inserted in the top of the cylinder, which it fills except that it is slabbed off at one side, as shown by the end view of it at the top of Fig. 26, where the plug is shown in position, there being a heavy spring on top of it by which the blow is cushioned in case the piston strikes the plug. The object in slabbing off one side of the plug is to maintain communication with the steam port at the upper end of the cylinder; and the plug can be adjusted to different heights by means of keys which may be passed through the slots formed in the rods *b b'*. The stuffing-box ring is slotted out to fit the plug, and packing is effected in the ordinary manner.

In this larger hammer the lower die is held in a piece which is in the form of an ellipse, and the four screws which hold it in place do not converge at one point, but are directed approximately toward the foci, as shown in Fig. 27, the result being that the die cannot only be moved bodily in any direction, but it can also be rotated by the screws in adjusting it to position, which could not be done were the die-holding plate made round.

CANADIAN TOOLS.

Canada does better in point of a tool display, the tools shown being essentially American in design, modified somewhat, however, by British ideas.

The London Machine Co. show two lathes, the larger of which they call a "break lathe" from the circumstance that the bed is in two parts, that portion which supports the head-stock extending to the floor and under the end of the remaining portion of the bed to which it is attached by bolts and T-slots which allow of a movement endwise to form a gap 4 feet long, and to admit work 62″ diameter, the diameter which will swing over the shears being 38″. The middle and other end of this movable portion of the bed slides over the legs, which are intended to be fixed to the floor or foundation and are planed on top and provided with gibs for holding the bed in place upon them. In front of the head-stock there is an extension of the bed which is near the floor and supports a post, on top of which is a compound rest for turning large work, the arrangement being much the same as in our driving-wheel lathes.

To avoid carrying the screw and feed rod out from the bed far enough to get past the break without interfering with work there (which would, of course, be impracticable,) a splined rod driven by the change gears in the usual manner is carried down through the center of the bed, and at the foot carries a spur gear from which the screw and feed

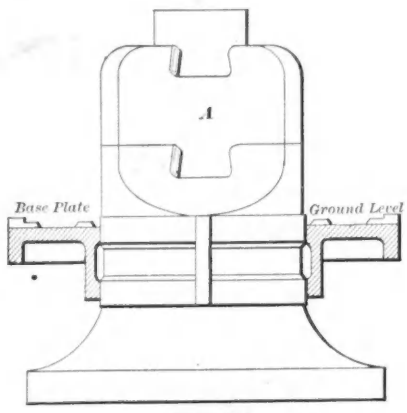


Fig. 25

rod are driven from the foot of the lathe, and they both terminate at the upper end of the movable portion of the bed, thus not interfering with the gap in the least, and being as close to the bed as they could be placed if the gap were not there.

The lathe is triple geared, the arrangement being shown at Fig. 28, which is a sketch not to scale. In this we are supposed to be looking at the back of the lathe, and *a* is the gear which is driven by the pinion on the cone pulley. Instead of being upon a quill this gear is keyed to and drives the shaft upon which it is placed, and the double pinion *b* slides upon the same shaft over a feather to engage with either the wheel *c*, which is keyed to the spindle in front of the cone pulley in the usual manner, or it may engage with the gear *d*, which is upon a shaft supported in the bearing *e* and carrying at its other end a pinion *f*, which engages with an internal gear on the face-plate, this latter shaft sliding endwise to engage or disengage the pinion *f*. The gear *c* is something more than twice its tooth depth larger than the flange of the cone pulley, so that the pinion *b* clears the pulley and belt.

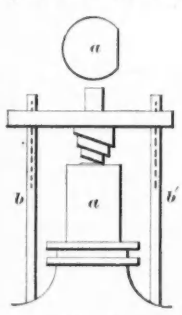


Fig. 26

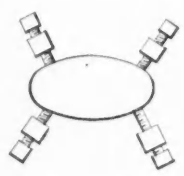


Fig. 27

The other lathe is 36 inches swing and the outside shears are 20 inches center to center; the angles formed by this proportion of things being shown by the triangle, Fig. 29, which is drawn to scale and is entirely too high for its width of base, according to our ideas of lathe construction.

Another Canadian firm represented is John Bertram & Sons, of Galt, Ontario. They have a 36-inch planer with 15-foot bed, which appears to be a good tool. It is driven by a parallel shaft with worm gear, and has a positive disengaging feed with all the other improvements which we are accustomed to see on modern planers.

The cross-rail is raised and lowered by power, and the screws for doing this rest at the bottom upon set-screws which pass through lugs cast on the housings, these

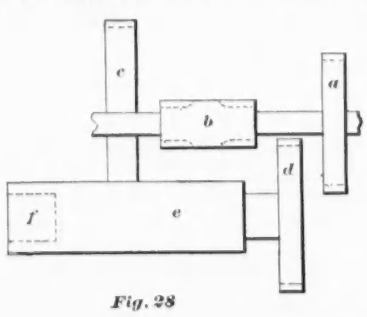


Fig. 28

set-screws being, of course, adjustable so that either elevating screw can be raised or lowered to adjust the cross-rail parallel to the platen.

Our friend Harrison would certainly find the handle of the down feed screw on this planer one that he should include in his examples of "Hand-wheel Lunacy," for it is made in the form shown by Fig. 30, consisting of a straight bar with a ball at each end, and which, of course, it is impossible to turn continuously. Below this is a sleeve or collar which has a shape like that shown instead of the simpler shape, Fig. 31, which almost any American machine designer would certainly have preferred This is the more noticeable from the fact that the rest of the machine is simple and plain in style. A very good steel chip is shown as illustrating the capacity of the planer.

A 15 inch shaper by the same maker is driven by the same device, which includes open and crossed belts and a worm with wheel. Personally, I do not believe this is the best way to drive a shaper of this size, because the point of reversal of the tool is not fixed with sufficient accuracy for die work and other jobs for which a shaper is especially adapted, but otherwise the shaper seems well designed and has a very staunch appearance.

They also show a 24-inch lathe with 12-foot bed, which appears to be a good tool; but instead of having a hollow spindle, as most of our lathes are now made, it has a solid one, and the end thrust is taken by the point of a ¾ inch screw, which passes through a yoke or strap at the back, this seeming to be a feature borrowed from English practice which would not meet with much approval in this country. It has our tumbler-gear plate for reversing the feed, but it is placed outside the head instead of inside it, detracting from neat

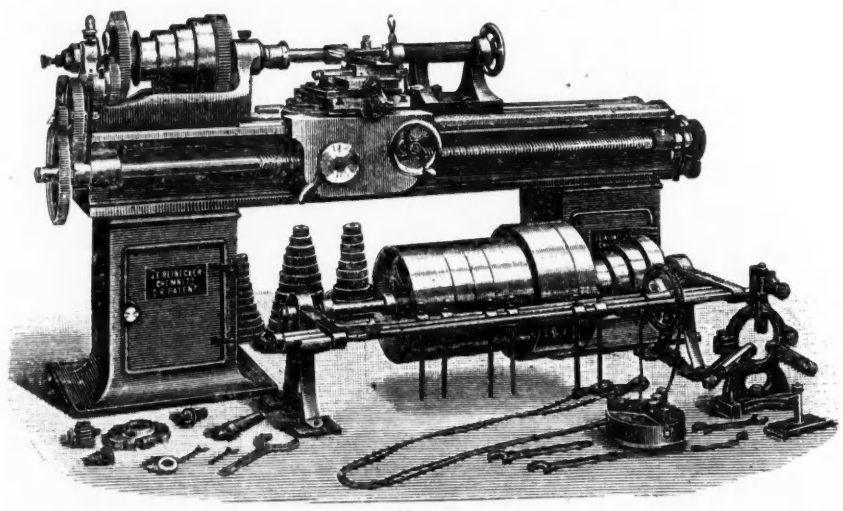


Fig. 33.

appearance, but on the other hand avoiding the opening through the web of the head stock, which is an advantage, of course.

There are two drill presses, which are modeled after the Prentice machine, with which our readers are familiar. In the spindle of the smaller one of these I noticed a high-speed attachment which is intended to be used when drilling with very small drills. It has a taper shank which goes into the spindle in the usual way, but instead of driving direct it does so through the medium of spur gears, which increase the speed in the ratio of 4 to 1, these gears being cased up in a light, thin case and one of them driven by friction, the amount of which can be regulated from the outside of the case by turning a knurled knob, it being practicable to so regulate the driving power that the gear will slip when the drill meets with any extra resistance. The case is prevented from turning by a rod which rests against the post of the press. The spindle of this attachment has a separate feed of its own by a small lever resisted by a spring, and the whole arrangement seems a good one and well calculated to facilitate the drilling of small holes where, as often happens, the shop is not supplied with a press adapted to such work. This is made by Stevens, Hamilton & Co., of Galt, Ont.

This drill press has another device on it which struck my fancy, and seems to be altogether the best device for gauging or rather indicating the depth of holes which I have yet seen. It may be understood by reference to Fig. 32, where *a* is the spindle sleeve and *b* the arm through which it passes, *c* being a beveled graduated plate which is revolved to the right as the spindle goes down, and indicates the depth to which the drill has gone, the movement being derived from small rack teeth formed in the sleeve. A concealed spring resists the motion of the disk *c*, and when the small knob *d* is pressed inwards this spring promptly returns the disk to zero. By this means, when a hole is to be drilled to a given depth, either the point of the drill may be brought down upon the work or the drill may be entered until it begins to cut its full size, as circumstances demand, after which it is only necessary to "press the

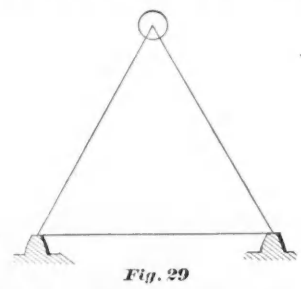


Fig. 29

button" and the disk is instantly set to zero and commences to indicate the further descent of the spindle. This comes in very nicely, also when two or more drills of different sizes are to be used in one hole. I have made but four graduations on the disk, leaving imagination to supply the rest of them.

Stevens, Hamilton & Co. have also a 12-inch pillar shaper which employs the slotted lever for the quick return.

GERMAN MACHINE TOOLS.

Only one German firm shows machine tools here, but its display is something of a revelation, and taken as a whole is certainly a very creditable one. It is quite evident in looking it over that they have borrowed many of their ideas from American tool builders, though they evidently have had

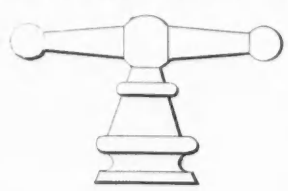


Fig. 30

Fig. 31

some of their own to add to them, and in borrowing they have been shrewd, discriminating and consistent. The concern is J. E. Reinecker, of Chemnitz, and the milling machine with its accessories occupies a very prominent place in the display.

The machine, Fig. 33, is one of the most prominent in the exhibit, and is a modification of the lathe, specially adapted to backing off milling cutters; their plan being in making a spiral mill to first mill spiral grooves in it, something as shown by Fig. 34, which represents an end view of one-half of a cutter. The forward edges of these grooves are radial, and the grooves are very much the shape of those in the B. & S. gear cutters. The backing off is then done in the machine, Fig. 33, and is accomplished by an operation very much like that of ordinary turning, except that the tool is moved in and out for each tooth to give the clearance, the carriage feeding along the bed in the usual way. German engravers of machinery are evidently no better than French engravers of machinery and both are about as bad as they can well be, but I hope the reproduction of the wood-cut, Fig. 33, will be sufficiently good to indicate the principal points of the machine, which I shall try to explain.

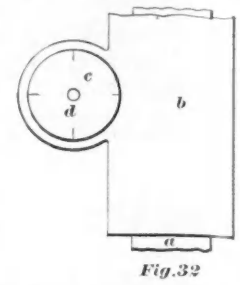


Fig. 32

It will be noticed that there is the usual saddle, just above which there is a compound rest. Above this is the broad plate in which the two T-slots are seen, and this plate is the one that moves in and out to give the tool the required motion for backing off the teeth. The motion is derived from a disk cam, Fig. 35, which is upon the upper end of a short vertical shaft which passes through the center about which this compound rest turns so that the rest may be turned to any angle, and the cam acts to give it the same motion at that angle, whatever it may be, thus providing for clearing cutters on the sides, if desired, or at any desired angle. Above this reciprocating slide is yet another compound rest, and above this two slides at right angles to each other, this arrangement allowing the slides to be placed at any angle for turning or facing independent of the angle at which the reciprocating movement takes place. It

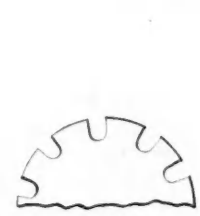


Fig. 34

Fig. 35

is evident from the fact that this cam has but one step that the vertical shaft on which it is placed must make a revolution while one tooth of the cutter is passing the tool, and this is provided for by change gears which drive the shaft and cam at the desired speed. But it is also evident that the rate at which this cam moves must be modified by the fact that the teeth of the cutter may be spiral, as shown, instead of straight.

I have had to study the machine with such assistance as could be rendered by a German mechanic whose English is no better than my German; our interpreter not being a mechanic, and both of them a little afraid that I would find out more about the machine than I ought to know, though very

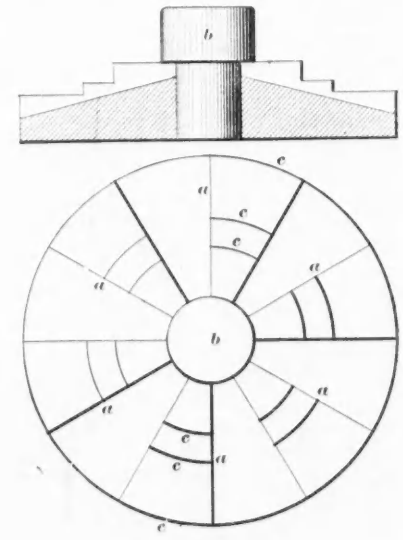


Fig. 36

friendly and pleasant. I hope, however, that I can make its action understood. It will be noticed that there is a feed screw in front which is driven by change gears in the

usual manner, and the carriage feed is by the nut, so that it is positive and at a known rate. At the back of the bed is a shaft which runs along the bed the same as the feed screw does in front, and is also driven from the spindle by a separate set of change gears which are at the rear of those which drive the screw. At the foot of the lathe this shaft carries a spur gear and drives another shaft which is splined and runs through the middle of the bed under the carriage. On this shaft is a bevel gear which drives another bevel gear, the latter being at the lower end of the shaft on which the cam, Fig. 35, is placed. Now it is evident that by choosing suitable gears at the head of the lathe this shaft at the back and the cam can be driven at the proper speed for the number of teeth that may be in the cutter.

It may be noticed also that there are gears attached to the lower end of the feed screw; these being a regular set of change gears which drive a stud that enters the end of the bed and disappears within a box formed there; this box being covered, and remaining covered, because the attendants thought it would not do to let me see its interior without special permission from Germany. It is evident, however, that the object of this is to modify the motion of the splined shaft which runs through the center of the bed, this modification being necessary to suit the angle of the spiral of the teeth of the cutter. Taking a cutter such as is shown in the machine, for instance, as the tool is fed along in the usual direction the in and out motion of the tool must be gradually retarded in order to compensate for the spiral of the teeth. Supposing this spiral to be at the rate of one turn in 36 inches, then when the carriage had moved 36 inches the cam would need to have been retarded in its movement as many revolutions as there were teeth in the cutter. Not having been able to get the cover taken off I do not know how this modification is effected, though one way of doing it has suggested itself to me, and there are probably various ways. Perhaps this would be a good problem for Mr. Leicester Allen to present to his students.

Though I greatly admire this machine, I am free to confess that I do not so much admire some of the cutters that are made in this way. They seem to have too much clearance, this being shown on the work done by the spiral mills, which is not as smooth as such milling can be done, this, however, being perhaps partly due also to the fact that apparently no attempt is made to make the cutters smooth on the outside; but the tool marks are left in them, and the grinding is all done on the radial front faces in the same manner as with the B. & S. gear cutters. The cutters must cost considerably more than those we use here, and even if such cutters were to be made here the clearance would probably be milled on the plain spiral mills, instead of being done in this way, and I should expect it to be done equally well, and at about one-fourth the cost of doing it on this machine; though of course this would not apply so well to some other forms of cutters.

In grinding the front faces of such spiral mills as these, a special grinding machine must be used in order to grind the teeth back uniformly, and there is so much more surface to grind that the grinding must be very much more expensive than with our form of spiral mill.

The machine comes in better, however, in such a cutter as that shown in Fig. 36, which is a plan and section of a cutter something like one shown in the exhibit, and is in the form of a disk of steel with the shoulders formed on its face, as shown, and with grooves milled in the face to form the radial cutting edges *a*. This disk or face cutter is sunk into the face of the work, the hardened plug *b* guiding it by means of a central hole previously bored. Now, if we imagine this disk to have the radial grooves already milled in its face, and then to be mounted in a chuck or upon on arbor in this lathe, Fig. 33, the reciprocating rest could be set at an angle of 45°, while the two upper slides were set square and parallel. The result would be that clearance would be given the cutter in both directions, *i. e.*, on the flat faces and on the outer edges as well, the clearance being equally divided when the motion takes place at an angle of 45° and variable at will as between the two surfaces by changing the angle. Of course for such a job the gears at the lower end of the feed screw wou'd be disconnected. By giving very small clearance on the outer surfaces such as *c c c*, this cutter can be ground on the radial cutting edges without materially altering its diameter, while, of course, the relative height of the shoulders upon it will remain constant, regardless of the amount of clearance.

A variation of this form of cutter is shown

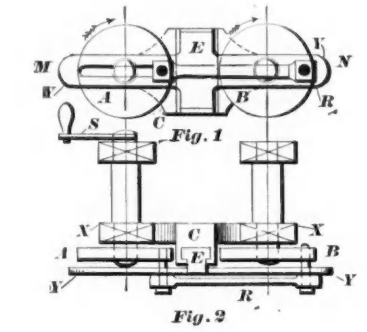


Fig. 1

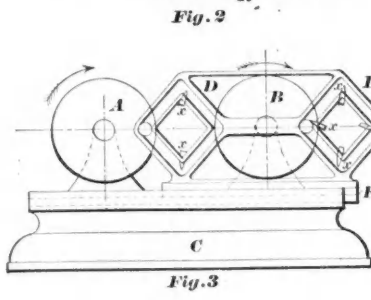


Fig. 2

Fig. 3

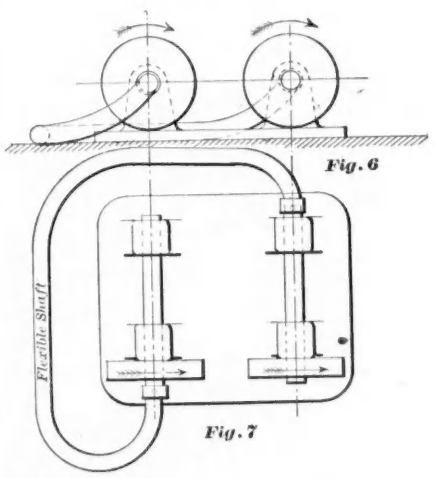


Fig. 6 Fig. 7

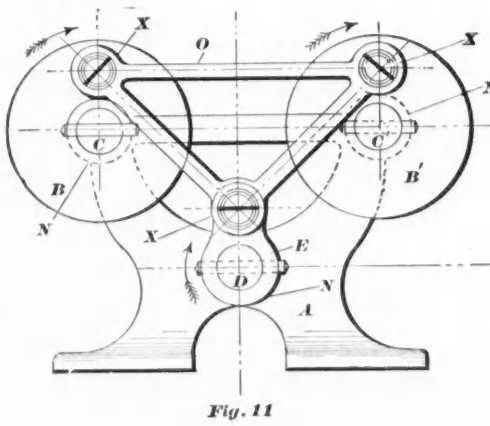


Fig. 11

which consists of a rectangular block having set into it two cutters set diametrically opposite each other with their cutting edges radial and secured in place by set-screws. They are turned and given clearance, in position, by the same means.

The further consideration of this exhibit and that in the French section will have to be deferred until next week. F. J. M.

Jackson Park, July 3.

Recent tests of armor plate by the Government appear to demonstrate that American manufacturers are making, if not the best in the world, at least that which is not surpassed. Such plate costs the Government $575 per ton, and it would appear that it costs $30,000 to $40,000 to test a lot, making it an expensive luxury.

On the Cultivation of the Inventive Capacity by the Solution of Constructive Problems.

BY LEICESTER ALLEN.

As I expected, from the solutions obtained for previous problems, the answer to the one announced in the issue of the AMERICAN MACHINIST for April 13 has drawn out some very interesting and unique solutions. In compliance with the suggestions of several gentlemen who have contributed to the widespread interest evinced in these problems, and who think they could be more conveniently referred to if numbered, I will refer to this hereafter as Problem No. 5. I should have pursued this course at the beginning, if either the editor or myself could have foreseen the interest the problems have aroused, and the desire so many readers have expressed for their continuance.

Fig. 4

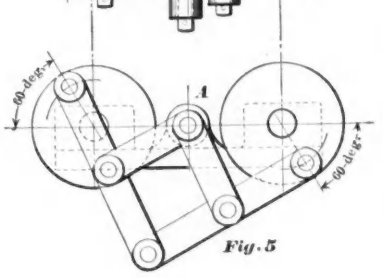


Fig. 5

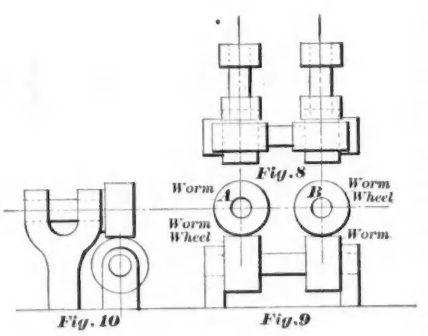


Fig. 8 Fig. 10 Fig. 9

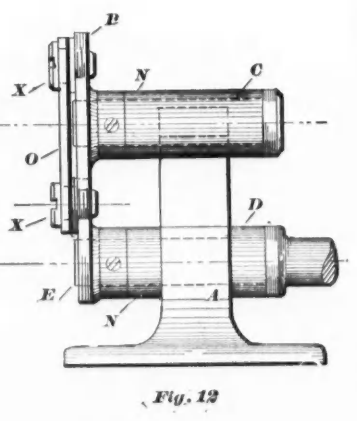


Fig. 12

The first two solutions I shall notice have been forwarded by Mr. F. Van Fleet, of Williamsport, Pa. The first of these is shown in Figs. 1 and 2, and Mr. Van Fleet's excellent description follows:

"*R* represents an ordinary connecting rod, connecting the wheels *A* and *B* by crank-pins, as shown. *C* represents a bracket connecting the boxes *X X* rigidly, and having on its outer face a planed T-slot. Sliding vertically in this T-slot is an arm *E*, having extensions at right angles to *E*. These extensions *Y Y* have slots in their extremities that pass over the crank-pins. These slots have a length greater than the throw of the crank pins. Connected to one of the shafts is a hand-crank for turning the driving wheel *A* in either direction. The operation is as follows: The connecting rod *R* drives the wheel *B* in the ordinary manner until it approaches either "dead point." The sliding bracket *E* and slotted arms *Y Y* having pressure applied in a vertical direction by the crank-pin of the driver *A*, force the bracket to slide either upward or downward, and of course carry the crank-pin of the driven wheel over the "dead center." This action will take place no matter in which direction the driver is turning or which wheel is the driver. The bracket *E* simply rises and falls in its T-slot, and assists the crank-pins over the "centers." The motion may be either rapid or slow, and is reversible, and either wheel may be a driver or a driven wheel.

"You exclude the use of double cranks on each shaft and double coupling rods in the solving of this problem, but say nothing about the use of single cranks; and a single coupling rod being admissible, I therefore take the benefit of the doubt, and submit this solution.

"In the second solution, Fig. 3, *C* represents the base having a planed T-slot in its top. The wheels *A* and *B* are mounted on brackets or bearings, as shown. Each wheel has a crank-pin placed at the same distance from the center. Sliding in the T-slot on the base *C* is an upright frame *F*, having a diamond-shaped section at each end. In each of these sections a diamond shaped groove is milled, as shown, thus forming a face cam in which slide the crank-pins on the wheels. The section D^2 is provided at its inner corners with sliding spring-pressed pins, *x*, *x*, *x*, *x*.

"The action of the device is as follows: On turning the crank on the driver *A* in the direction shown by arrows, its crank-pin causes the frame *F* to reciprocate on the base *C*. Whenever the crank-pin on the driven wheel *B* passes one of the angles in the frame D^2, it passes over one of the pins *x*, which, immediately springing out again, effectually prevents the crank-pin from returning on the path over which it came, and compels it to turn the angle and move forward in unison with the crank-pin of the driving wheel.

"It is evident that this motion is positive and practically continuous, and will do very well for slow speeds, such as this problem calls for, but is not reversible, and would be useless for high speeds. It is submitted more for its oddity than its practicability.

"The first solution is practicable, works very smoothly at almost any speed, and is entirely reversible, either by change of motion or change of driver.

"I derive much pleasure in following your articles on this subject."

With reference to Figs. 4 and 5, Mr. John McNutt, who forwarded them, writes:

"In response to your problem in the AMERICAN MACHINIST of the 13th inst., I submit the inclosed sketches, in which is shown the application of the pantograph principle, and which seems to me to be a solution complying with the conditions. Would say that I find the past articles very profitable reading, so am yielding to the desire to join the class."

I am very glad to receive Mr. McNutt's excellent solution. It may be proper to say that this device is probably not new. I think I have seen it somewhere, although I cannot quote chapter and verse where it can be found. I have no doubt, however, that it was independently worked out by Mr. McNutt. Had I recalled the movement when I gave out the problem, I think I should have excluded it in the restrictions. The movement is, however, a good one; all the pins are movable except the one at *A*, which is set in a fixed bearing; and the operation will be obvious without further description. It will be seen that either disk may be the driver, and that the movement may be adapted to quite heavy work and rapid speeds.

Mr. Carl F. Jeansen, West Troy, N. Y., sends in a solution which, while it must

be accepted as not conflicting with the terms in which the problem was announced, is yet an old device. In trying to exclude old and well-known devices, this one escaped me. I presume, however, that it is new to some, as several such solutions have been offered. The solution depends upon the use of a flexible shaft, but while this does not give a very positive movement, and the velocity ratio of the driven wheel is liable to vary from that of the driver, Mr. Jeansen explains that by using universal couplings arranged in such a way that "the errors in the couplings eliminate each other, or by using the 'Almond' quarter-turn coupling" the same principle would be carried out. He adds that "if crank pins without connecting rods are allowed to be used, several ways of transmitting the motion can be found. Hydraulic machinery and at least two different systems of levers will give the desired result. In these cases the crank-pins work in slotted levers. Two crank-pins are, of course, used on every shaft, put at right angles to each other. Eccentrics working in slotted levers will also serve the same purpose.

"In every case above mentioned, the motion is reversible, and either of the shafts may be the driven."

I should be glad if Mr. Jeansen would add to these instructive hints a description of any method by which the errors of universal couplings can be made to eliminate each other that is not now known, if he has thought of any such method, and also the method of gaining the required movement by hydraulic machinery, as I think these would be of great interest to many readers of the AMERICAN MACHINIST.

Although Mr. Jeansen does not expressly say so, I have rather inferred from his letter that he had in mind some original plan for universal couplings.

Mr. David Eddowes, of Philadelphia, Pa., has forwarded three solutions, one of which is substantially like that given by Mr. Jeansen in Figs. 6 and 7, a second one of which violates the restrictions of the problem by the employment of friction wheels, and the third of which is illustrated in Figs. 8, 9, and 10.

Mr. Eddowes writes that he has been very much interested in this series of articles, although this is the first time he has tried to solve any of the problems. What Mr. Eddowes styles a system of "worm-wheels" produces the movement desired. This can be made to give a strong, positive movement, but only one of the wheels can be a driver. A worm-wheel movement is not adapted for practical use with high speeds, and if worked against much resistance the friction would be great.

Mr. F. J. Miller, associate editor of the AMERICAN MACHINIST, has suggested to me that as helical gears are quite commonly miscalled "worm-wheels," and as the diagram supplied by Mr. Eddowes shows the wheels all apparently of the same diameter, it is probable that helical gears were meant instead of worm wheels. If so, the device would work in either direction, and either of the two wheels in the problem might be a driver. The wheels could also be worked at a considerable velocity.

An extremely neat drawing and an excellent solution has been received from Mr. Francis W. Clough, of Springfield, Mass. Mr. Clough has contributed excellent solutions to previous problems. With reference to the value of this kind of study, Mr. Clough writes: "Your problems tend to develop the constructive faculties and are of benefit to all." His explanation of the movement shown in the figures follows:

"*A* is a frame having on it a base and hubs *N*, *N*, *N* for bearings of the two shafts and disks required to be rotated; the hub below supports the shaft *D* and crank *E*.

"*B C* and *B' C'* are the disks and shafts you show in the problem.

"On the disks *B B'* are two crank-pin screws *X* located the same distance from the center as is *X* on crank *E*, mounted on shaft *D*.

"The location of the shafts in this solution is important; *C* and *C'* should be 45° each from a vertical line drawn through *D*. Connecting the three crank pins thus located is the triangular connecting rod *O*, having three pivot holes at *X*, *X*, *X*.

"As I have drawn the sketch, I have made the shaft *D* and crank *E* to be the driver. However, either of the shafts, if continued to the rear and connected to power, will drive as well, and in either direction; and perhaps you would so suggest in accordance with the strict letter of your requirements in the problem."

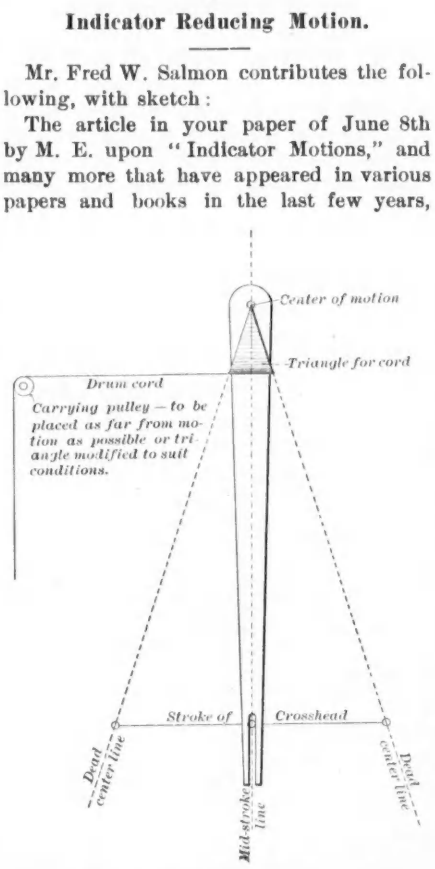
It will be seen that no one of these solutions except the flexible shaft movement avoids the use of some attachment not supported or carried by the wheels themselves, and so while they are all correct solutions they do not attain the ultimate end sought in giving out the problem, as will be seen by a re-perusal of the remarks at the close of my article in the issue of April 13th.

What is called a North and South Gulf railroad is proposed to be built, which is to traverse the country from north to south, and an enthusiastic individual who attended a recent convention held in the interest of the proposed road, said that it should be an "electric line, and that the artesian wells of the Dakotas, the streams, creeks, rivulets and rills in the country through which it was to pass, as well as the tide in the Gulf of Mexico, and the winds that sweep over these prairies should be harnessed to furnish the power." The proposition was thought important enough to be made the subject of a special press dispatch; and we suppose such a scheme does seem very attractive to one who has never investigated the probable cost of developing and using power in this way as compared with the usual methods. There is considerable of the poetic element in the words quoted, it will perhaps be noticed, but the poetry would be much damaged by figures showing the cost of a complete set of harness for these various forces of nature. If the road is built within the present generation it will probably be operated by such locomotives as we are now familiar with.

Indicator Reducing Motion.

Mr. Fred W. Salmon contributes the following, with sketch:

The article in your paper of June 8th by M. E. upon "Indicator Motions," and many more that have appeared in various papers and books in the last few years,


Center of motion
Triangle for cord
Drum cord
Carrying pulley — to be placed as far from motion as possible or triangle modified to suit conditions.
Stroke of Crosshead
Dead center line
Mid-stroke line
Dead center line

have been very interesting to me, and thinking that the one shown in the engraving might be of use or interest to others, I send it. Although I rarely see it used in this country, it gives a motion approximately correct to the paper drum, and it is easy to make.

It should be constructed so that a line drawn from the center of motion when the engine is on either dead center, will form a right angle with the drum line and be of equal length (*i. e.*, may be isosceles or perhaps equilateral triangle, but never a scalene triangle) and of such proportion to the engine and pendulum as to give the desired motion.

The subject of the substitution of malleable iron castings for forgings was received without enthusiasm at the Master Mechanics' Convention, which was what might have been expected. Malleable iron is a good thing in its way, but its way is not much in the direction of locomotive parts.

Improved Twenty-inch by Seven-foot Cabinet Turret Lathe.

The accompanying engraving shows a newly designed brass finisher's lathe that is being put on the market by the Lodge & Davis Machine Tool Co., of Cincinnati, O.

The turret is so designed that one slight backward movement of the handle loosens it, and at the same time withdraws the locking pin, while a slight forward movement produces the fractional revolution of the turret for the next tool, at the same time locking and tightening it, the entire operation being done instantaneously and with one hand. It is provided with automatic engine feed with three changes, which may be reversed by the handle at the left hand side of apron, and directly at the hand of the operator. There is also a longitudinal movement by either lever or screw. The top slide rests upon a slide having a right-angle hand movement operated by a screw at the front of the machine, allowing a large range for facing off work held in chuck. When using this hand set over, the holes in turret can always be brought central with spindle by a positive stop. The stop can be quickly removed when tools are to be used on back side of center of spindle.

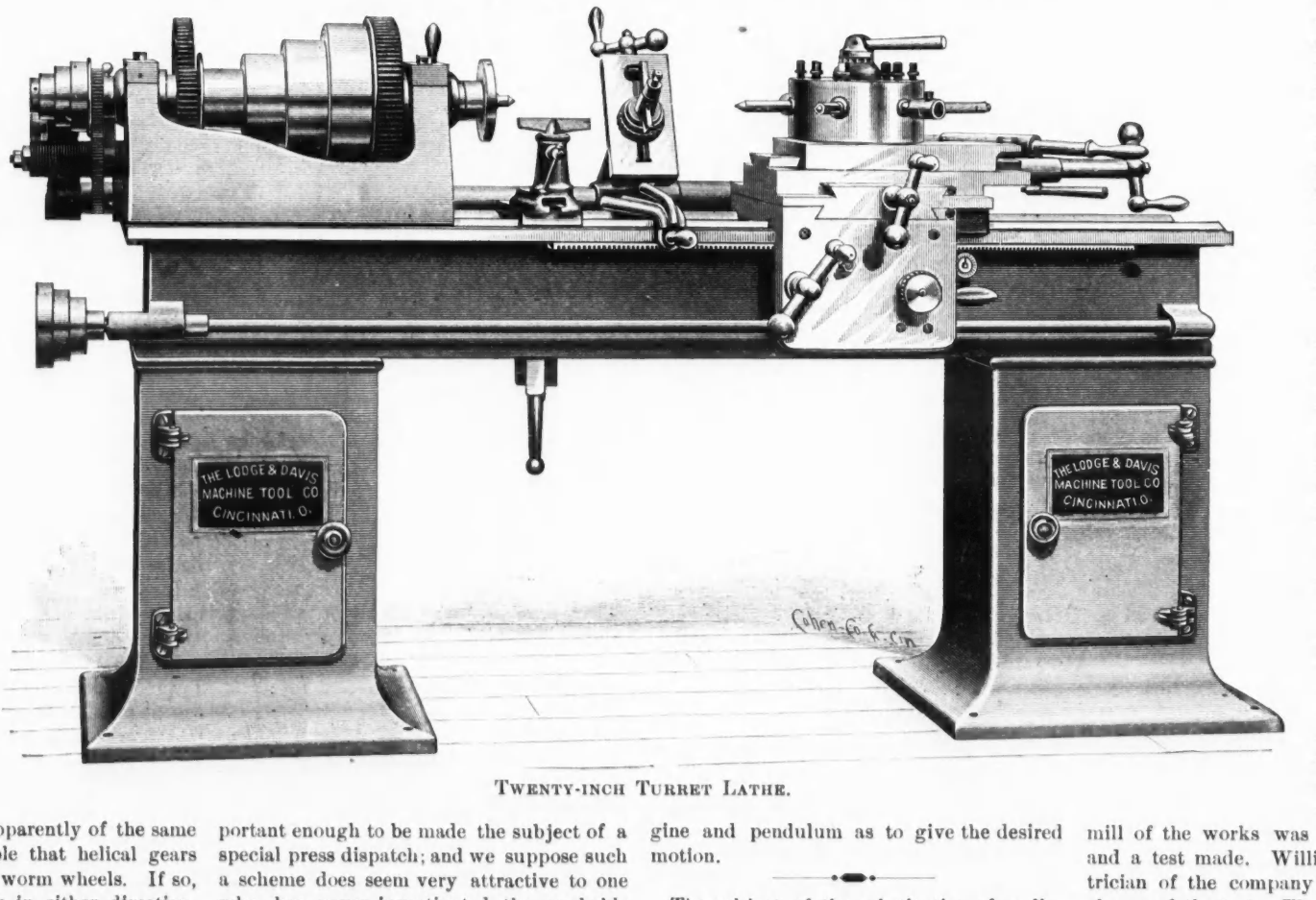
The slide has an additional cross movement operated by a supplementary taper slide, taper being derived from a bar between the ways of the bed. The bar can be set by a graduated index to obtain any taper up to 4 inches to 1 foot. This obviates the necessity of setting over the head-stock for taper boring or turning, and by this new taper attachment work can be faced off square when taper work is completed, without any change. When used for straight work the taper slide is locked to saddle by a taper tool steel pin, having a square head for its ready removal.

The automatic feed allows pieces of any length within the range of the machine to be operated on. When automatic feed is not used the saddle may be locked to bed by gib screw at right-hand side of apron.

The cone pulley has steps of large diameter and the machine is strongly back-geared. The spindle is of steel, accurately ground, and has a large hole through it.

The chasing arm has a tilting handle by which the operator can back the arm to the under side of bed, and prevent its lifting when in use, while it is free to slide endwise. Straight or taper threads may be cut, and the change from one to the other may be made instantly.

With this machine left-hand threads may be cut with right-hand leaders, thus saving the cost and annoyance of a separate set of left-hand hobs and leaders.



TWENTY-INCH TURRET LATHE.

An electric crane has been successfully tested at the Edgar Thomson works of the Carnegie Steel Company, Limited. The great traveling crane to be erected in the ladle house of the converting mill of the works was put up last week and a test made. William M. Pierce, electrician of the company at the works, had charge of the test. The crane raised about 100 tons. It will operate ladles exclusively. —*Railroad Gazette.*

Five-hour trains are now running between New York and Boston. They have been a long time in coming.

Improvements in Jenkins Brothers' Valves.

Inquiry as to recent improvements made by Jenkins Brothers, 71 John street, New York, in their well-known valves, shows these improvements to consist in a new and improved manner of holding the disk-holder in place, an increased number of bolts in bonnets and an increase in the thickness of flanges. Only one grade of valves is made, suitable for either high or low pressure steam.

The greatest improvement, however, is in the rubber compound for disks. This firm have experimented for years in the way of making a compound that should be entirely satisfactory for high-pressure steam, and have succeeded in producing a material for disks with which they are fully satisfied after protracted tests.

The Messer Elastic Rotator.

One of the considerations that led to the invention of the device shown herewith was the overcoming of the trouble arising from unbalanced emery wheels.

It is a well-known fact that an emery wheel cannot be made so perfectly homogeneous as to be in perfect balance; in the very nature of things it will be more dense in some places than in others, which tends to produce an inequality of centrifugal strain consequent upon the well-known irregularity of motion of unbalanced wheels.

An inspection of the engravings will show that while the wheel is held between flanges, springs are interposed between the hub carried by the arbor, and the annular ring that centers the wheel. It will be evident that these springs will yield to the tendency of the heavy side of the wheel to "throw out," which it will do to a limited extent. If now, while running in this condition, the wheel is turned—trued up—it will be, so far as running conditions are concerned, balanced.

It is furthermore claimed for this arrangement that a wheel so cushioned will cut faster than one rigidly held, as the conditions obtained by the springs admit of the work being kept constantly in contact with the wheel; also that the yielding center prevents undue and uneconomical contact of the work, and reduces the danger of an accident with the wheel.

This device is said to be applicable to many other purposes than the one referred to. It is manufactured by the Messer Elastic Rotator Company, 62 N. Fourth street, Philadelphia, Pa.

The Cycloid.

BY F. R. HONEY.

The cycloid is usually constructed by drawing the generating circle in different positions. The describing point is marked in each position of the circle, and the cycloid is traced through the points thus obtained.

This method involves the use of the curve ruler, which, in drawing, should be avoided whenever practicable.

A very fair approximation to a cycloid may be constructed by drawing five arcs of circles, employing for radii the radii of curvature of the cycloid at points judiciously selected. By this means the two halves of the curve are made symmetrical, and it is easily drawn in ink.

THE CONSTRUCTION.

Let A, Fig. 1, be the generating circle and a the point which describes the cycloid. Draw $c\ c'$ tangent at b, the extremity of the diameter $a\ b$, equal to the circumference of the circle A, making $b\ c = b\ c'$.

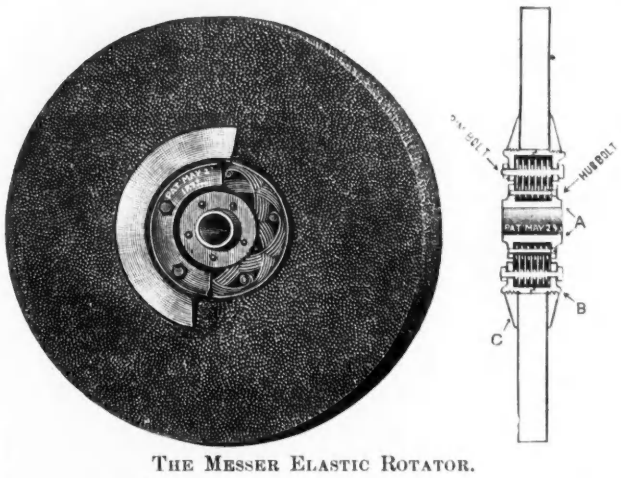
Calling the diameter of the circle D, the lengths of the radii which should be employed are $D \times 0.518$, $D \times 1.414$ and $D \times 1.932$.

The scale, Fig. 2, may be used in constructing any cycloid. To make this scale draw $a\ b$ any convenient length.

Lay off $a\ c = a\ b \times 0.067$; $a\ d = a\ b \times 0.518$; $a\ e = a\ b \times 1.414$, and $a\ f = a\ b \times 1.932$. Draw $a\ g$ at right angles to $a\ f$ any convenient length. Join $f\ g$, $e\ g$, $b\ g$, $d\ g$ and $c\ g$. Draw $g\ h$ parallel to $a\ f$.

To illustrate the method of using the scale let it be required to determine the radii which should be employed in drawing the cycloid, Fig. 1.

Lay off on $g\ h$ a distance $g\ h$ equal to $a\ b$, the diameter of the circle A. Draw $h\ b'$ parallel to $g\ a$, intersecting $b\ g$ at b'. Through b' draw $a'\ f'$ parallel to $a\ f$. The



THE MESSER ELASTIC ROTATOR.

line $a'\ f'$ is divided proportionally to $a\ f$, and the radii for the cycloid are $a'\ d'$, $a'\ e'$ and $a'\ f'$.

Draw $e\ e'$, Fig. 1, parallel to $c\ c'$ at a distance from it equal to $a'\ c'$, Fig. 2. From a center c with a radius equal $a'\ d'$ draw an arc intersecting $e\ e'$ at g.

On $a\ b$ produced lay off $a\ h$ equal to $a'\ f'$. The points g and h are two of the required centers.

To determine the third center, from the center g with a radius equal to $d'\ e'$, Fig. 2, draw an arc; also from the center h with a radius equal to $e'\ f'$ draw an arc intersecting the former at k.

Join $h\ k$ and $k\ g$ and produce these lines. From the center h with the radius $h\ a$ draw the arc $a\ l$; from the center k with the radius $k\ l$ draw the arc $l\ m$, and from the center g with the radius $g\ m$ draw the arc $m\ c$. The other half of the curve being symmetrical with respect to $a\ b$ is obtained in precisely the same way. The arc $l\ l'$ is described with the radius $a'\ f'$, Fig. 2; the arcs $l\ m$ and $l'\ m'$ are described with the radius $a'\ e'$, and the arcs $m\ c$ and $m'\ c'$ are described with the radius $a'\ d'$.

ANALYSIS OF THE CONSTRUCTION.

The evolute of a cycloid is an equal cycloid.

If we cut a cycloid in halves and place the two parts end to end as at a, Fig. 3, we have the evolute or locus of the instantaneous centers of the cycloid. If the upper cycloid or involute be drawn any point of the lower one may be found as follows: Let B be any position of the generating circle, b the describing point, and $c\ d$ the diameter of this circle drawn from d the point of contact with the base of the cycloid. Draw the normal $b\ d$ and produce it to k', making $d\ k' = d\ b$. If from k' as a center with a radius $k'\ b$, we draw an arc of a circle (the broken line) this arc represents the curvature at b; and since it coincides with the cycloid only for an infinitely short distance, one part falling *within* and the other part *without* the curve if the center k' be moved into the position k, corresponding to k of Fig. 1, employing the same radius as before, the arc is brought into a position which may be accepted as a representation of the cycloid for a short distance. Similarly the center of curvature at f is on the evolute at h'. If from the center h corresponding to h, Fig. 1, with the radius $h'\ f$, we draw an arc, this may also be accepted as a representation of part of the cycloid.

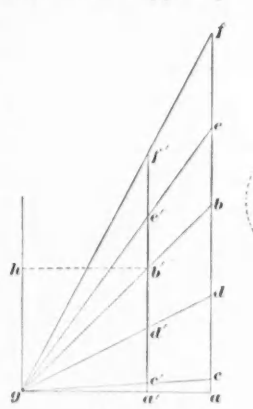


Fig. 2

The center g, corresponding to g, Fig. 1, is taken on the evolute. From this point with the radius $g\ e$ the arc through the point e is described.

The points e, b, f, and the corresponding symmetrical points on the other side of the axis of the cycloid are on the generating circle at regular intervals, *i. e.*, when the normal to the cycloid forms with the base angles respectively of 15°, 45°, 75°, 105°, 135° and 165°, these normals being respectively midway between the following positions, viz.: 0°, 30°, 60°, 90°, 120°, 150° and 180°.

The length of the radius of curvature is equal to twice the length of the normal. Thus $b\ k = 2\ b\ d$. The angle b, c, $d = 45°$; therefore $b\ k' = 2\ c\ d\ sin.\ 45° = c\ d \times 1.414$. Similarly $f\ h' = 2\ c\ d\ sin.\ 75° = c\ d \times 1.932$, and $e\ g = 2\ c\ d\ sin.\ 15° = c\ d \times 0.518$.

The perpendicular distance from g to the base of the cycloid is equal to one-half of $e\ g$ multiplied by the sine of $15° = c\ d\ sin.^2\ 15° = c\ d \times 0.067$.

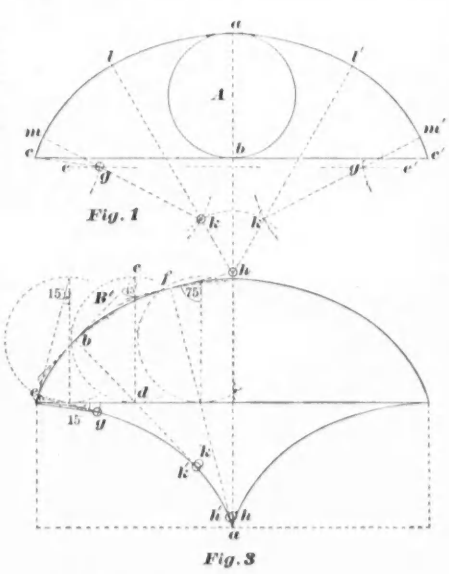


Fig. 3

THE CYCLOID.

The Progress of Photo Printing.

BY C. WILLICH.

It would undoubtedly be a great improvement and of much advantage if *positive black prints* could be made as easily and as cheaply, and with as much certainty as blue prints. Unfortunately the possibilities in this direction have not been developed as far as they might have been, probably because interested experimenters hoped to be able to reach results which would be remunerative to them if they kept them to themselves. It seems to me that if every worker in this field would make known his progress, or what he considers such, the end in view would be attained better and sooner than if each one tried to monopolize a process which seems destined to become even more universal in its use than the blue-print process. Acting on this opinion I give you an account of what I have done and of the results. I was led into experimenting about three years ago through a statement in a German technical book* that a developer could be applied to paper simultaneously with the sensitizing solution, for which statement Herschel is given as authority. I tried to apply this to the well-known Poitevin Ink process, *i. e.*, to expose paper coated with a sensitive iron preparation, and to develop it on a saturated solution of gallic acid. I overcame the immediate action of the gallic acid on the iron, when combining the solutions, by adding hydrochloric acid and later substituted for gallic acid the less soluble tannic acid. The formula which gave the most uniform results I found to be the following:

Dissolve 7 ounces white rock candy in one pint water.

Dissolve ¼ ounce Tannic acid in 4 ounces water.

Dilute one ounce Tinct. ferri-chlorid N. S. with 6 ounces water.

Dilute 2 ounces Hydrochloric acid with 6 ounces water.

Dissolve ¼ ounce Tartaric acid in 3 ounces water.

Dissolve ½ ounce Oxalic acid in 3 ounces water.

These solutions being combined in the order stated, I prepared the paper in the dark-room and also dried it *there*. As soon as the paper is dry it gives a faintly visible print in three to four minutes in sunlight, and this print is fixed by soaking it in water. It seems not advisable to rinse it, as the lines seem to require some time to combine with the paper. Only very good animal sized paper seems to be adapted to this process.

The drawback, and the only one I have discovered, is that the paper is subject to the influence of the weather, so that under unfavorable conditions (moisture) it spoils in a few days, although in most cases the paper can be restored by thoroughly drying it, provided the chemical action has not gone so far as to blacken it.

* Schuberth, Lichtpausverfahren, Leipzig, 1883.

LETTERS FROM PRACTICAL MEN.

A Correction.

Editor American Machinist:

"Cam Rolls," June 29, 1893, p. 6, fourth paragraph, should read: "With the small roller E in a cam time less by $A\ B$ than $C\ D$, the roller is moved from rest by an accelerated motion through the distance $J\ K$, that is to say, an equal distance in less time," etc., instead of "a *greater* distance in less time," as first printed. EASY WAY.

What Is a Mechanical Engineer?

Editor American Machinist:

Various considerations, one of which is the near approach of the meeting of the Engineering Congress in Chicago, move me to ask, What is a mechanical engineer?

Most persons would naturally answer that it is one who has received the degree at some college or school, or perhaps that it is one who has knowledge of the theory and practice of the mechanic arts. It is not this phase of the question, however, at which I am looking, but at the relationship which the mechanical engineer, as a professional, bears to the business public. To illustrate what I mean, I will say that mechanical engineers seem to be divided into two classes:

First, those who earn a living by manufacturing or selling some special article, but who do not sell their professional services except on particular and extraordinary occasions, and

Second, those who do a strictly professional business, without making anything by commissions or profits on sales.

Of course there are all shades of intermediates between these extremes, but the distinctions here drawn serve the purpose of the question asked at the beginning. Distinctions of this kind are clearly recognized in nearly all lines of business except mechanics, in which business the distinction is practically obliterated as far as public recognition goes. Perhaps it would be more proper to say that the second class is not recognized as existing at all, although there are a few individuals of the kind scattered over various parts of the country.

In building, there are the architects, the contractors, and the agents or supply men; in medicine, there are the physicians, the druggists, and the manufacturing chemists; in literature, there are the writers, the publishers, and the booksellers. In mechanics why should we not have the mechanical engineer, the manufacturer and the agents each with his field clearly defined and publicly recognized; and why should the man

who gives his whole time and energy to becoming an expert in mechanical principle, and machine design have absolutely no recognized standing at all unless he acquires it by inventing some new device, and succeeds in inveigling some capitalist into manufacturing it for him?

Perhaps it may be answered that many of these manufacturers and manufacturers' agents *are* mechanical engineers, and are entitled to be called such at any and all times. Granting this to be true, it is only necessary to add that many contractors are also architects, and many druggists are also physicians, but this fact does not prevent the professional architects and practicing physicians from having a recognized standing independent of that of the contractor and the druggist.

Again I ask, What is a mechanical engineer? If it is the designer, the manufacturer, and the local agent alike, then as far as mechanics go we are on a par with the savage tribes, where the "medicine man" comprises all that there is to the doctor, the druggist, and the manufacturing chemist, and it is high time some move was made toward differentiation, and proper titles given to each class. I hope that those who attend the Engineering Congress in Chicago during the first week in August will take this matter up, and give it the consideration that it deserves. C. L. REDFIELD.

The Action of the Injector—Indicator Reducing Gear Criticism.

Editor American Machinist:

I note that Mr. Kinealy is on the path again. He now says he would have attempted no criticism had I stated originally that I did not pretend to give a correct equation for the flow of steam. This, I take it, is equivalent to charging me with having claimed that the equation I gave was absolutely correct. Now, if he will turn to my original letter, which appeared in the AMERICAN MACHINIST of March 9th or thereabout, he will, if he reads more carefully than he evidently has done, see that I give the formula with the words "*I cannot give its origin, but believe it to be generally accepted as fairly correct.*" In all fairness, I think I may claim that I never put it forward as correct, or I should have missed out the word "fairly," which means *approximately*, or *nearly*. Mr. Kinealy might on his own showing, therefore, have reserved his not too courteous criticism, or at least have added that while my formula was not strictly accurate, there was no formula that was accurate, for the simple reason that the rate of flow of steam had never been absolutely determined. The formula I gave is one of the simplest; but if Mr. Kinealy knows of a better one he could have given it, and the resulting figures could have been employed in determining the jet velocity. Instead of that he offered a thermodynamic equation, which was no explanation whatever of the mode of working of the injector, but simply a general equation for a heat engine, and his present charge against me of presumption in rating low down the education of our fellow-readers is simply begging the question altogether, and about on a par with charging the editors with presuming on their readers' want of intelligence by not publishing the AMERICAN MACHINIST in classic Greek.

I am of opinion that the knowledge of the higher mathematics is not a marked characteristic of engineers and machinists generally. There is room for a few high-class mathematicians only in general engineering, and any specially gifted blossom out as professors. Very certainly those who are mathematicians will not trouble themselves to read the mathematics in the various mechanical papers; they are the ones who will more often be found reading the shop wrinkles, of which I will be presumptuous enough to say they are probably quite ignorant.

I find myself so ignorant of so many things that I feel no compunction whatever in assuming that large numbers of my fellows are also very ignorant of many things, and I take it that an explanation on any subject from a man who has wrestled with such subject is worth more than a high-flown dogmatic statement from a man of so sublime an erudition that he must demand from others an accuracy of statement which he is after all incapable of giving himself.

The figures which the formula give, do, if worked out in conjunction with the observed temperatures and pressures of the exhaust injector, correspond with facts. Any other formula for steam flow, either more or less accurate, will probably give results but little differing. Unless I am mistaken, this formula is the one used some years ago by a committee of leading mechanical engineers, which sat upon safety valves—not *de facto* safety valves, of course, or the committee might not have remained to publish their findings—with a view to determining the necessary area of valve for a given grate surface. They concluded that the customary allowance of safety valve area of so much per square foot of grate area was quite wrong, for while a foot of grate would practically evaporate an equal weight of water at all pressures, an inch of safety-valve orifice would discharge a weight of steam approximately in proportion to the pressure, from which they concluded that low-pressure boilers really needed valves very much larger than do high-pressure boilers, pointing out also that a valve which allowed pressure to rise say five pounds above the pressure of blowing off put a much heavier proportionate addition of stress upon a boiler rated at 20 pounds than upon one rated at 100 pounds.

Absolute accuracy in everything is very desirable, but no more so in a useful though only approximate formula than in a drill press or a lathe, but if we are to abjure all turning operations until we are provided with an accurate lathe, I fear we must all shut up shop. All our best valve gears give inaccurate motions to slide valves and the best of our parallel motions in the old beam engines were but curve delineators, and yet James Watt and all after him made use of them simply because they filled the bill, being intelligently employed.

As an example of accuracy overstrained, we might take the pointing out of the errors in Indicator Reducing Gear, by M. E. in a recent number. M. E. takes Mr. Carpenter's angle plate gear and makes a very distorted drawing of the same, increasing the vertical side of the triangular cam and reduces the length of the arms of the lever. He assumes a long indicator card which no one would use in indicating a high speed engine, and the result is a large angular movement of the arm which takes its motion from the cam, and a distortion far in excess of anything which would occur in practice. Indeed is it not quite possible that the remaining slight distortion of the ends of the diagram would be counteracted by the elasticity of the short cord connection? Then I do not think that M. E. has correctly read some of the criticisms which advise a Brumbo pulley on a vertical arm. The addition of the Brumbo is for the purpose of pulling the cord over a circular arc in place of along a chord, and not for the purpose of correcting the angularity of the connecting chord. Is not this gear after all as good in practice as almost any other, and very convenient? How would it show for example, if the levers were 12 inches long, the engine stroke 1 foot and the cord only 1½ inches in length, giving a rise and fall of the cam end of the horizontal arm only one-sixteenth of its radius, and a departure from its true position on the cam face about .002 of the lever arm? This would be .024" or barely one-fortieth of an inch, and one-fortieth of an inch measured along the horizontal line of the triangular cam is equal to an eighth of a fortieth on the vertical side. The ends of the diagram would be therefore $\frac{1}{320}$ of an inch out of place. The smallness of this amount seems to explain why in M. E.'s diagram it was necessary to employ dimensions of levers and cams which would not be employed in actual life, and after all it is with problems of actual life that we are all concerned. At the same time we have to thank M. E. for drawing attention to the possible errors which the gear might give if not well proportioned, and to do this he quite properly used exaggerated dimensions, because had he attempted to make an accurate drawing he would have failed for lack of fine pens, and by the time his drawing reached our eyes the engraver and the printer would have contributed their quota, and the difference would have been lost.

The difference of motion at each end of the diagram is, of course, that between the sine and tangent of the angle whose tangent is a sixteenth of the radius, that is, about 3½°. M. E. showed how we might slightly curve the cam face to give an absolute correction. Would it not be as easily done by shaping the end of the lever which rests on the cam in such a way as to give the same result if dimensions must be chosen which demand this correction to be made? We must not, however, forget the cord action and the inertia of the indicator barrel.

W. H. BOOTH.

Magnesia Instead of Clay or Chalk.

Editor American Machinist:

In making tracings I apply magnesia to one or the other side of the tracing cloth to make the ink flow freely. I never use chamois or a woolen rag; they get dirty very quickly. I use a sponge. Cut a small sponge in two with a sharp knife, and use the flat surface for rubbing in the magnesia. When the sponge gets dirty wash it. Bricks of magnesia are sold in the drug-stores. A. W.

Paying Workmen.

Editor American Machinist:

The letter in your issue of July 6, from Messrs. Fay & Scott, of Dexter, Me., about wages of workmen, should have some discussion, as it is a point where many employers take advantage of their employes, and it is, I believe, the first letter of this subject yet published in the AMERICAN MACHINIST.

Messrs. Fay & Scott have my thanks and, I believe, the thanks of many others too. The tone of the letter indicates that that firm are appreciative employers to work for; hence no trouble with the men leaving in an unfair manner.

I have worked many years at the trade here in Philadelphia, and in reference to this matter can say that here the large machine tool shops pay their workmen every two weeks, to which there seems to be no complaint from the workmen. In other shops the pay-day varies considerably. In some shops the week ends Wednesday, pay on Friday.

In quite a number of shops the week ends on Saturday, pay on Tuesday, Wednesday or Thursday, and in a large number of shops the week ends on Wednesday to Friday, pay on Saturday. Not many shops pay to date on Saturday.

My idea of the matter is that the week should end on Friday evening, pay Saturday evening. Last winter I had occasion to visit Cincinnati, O.; while there I became acquainted with a firm, employing from 30 to 40 workmen, which keeps one week's pay back, and any one working there would have to work two weeks for one week's wages. I was told by an employe of this shop that there are many shops that do the same thing in Cincinnati. This I consider wrong to the workmen.

I think the pay-day should be standard.

A TOOLMAKER.

The Boston *Transcript* has been investigating the reports of the prospective wholesale closing of mills in New England and finds them unfounded. Prefacing an interview with the representatives of some of the largest mills the *Transcript* says: "There is apparently small ground for the rumor that mills in the large manufacturing towns of New England will be shut down for an indefinite period."

It is a good time, and the part of wisdom, to refuse to take stock in the predictions of those who profess to see gigantic industrial disaster impending.

A Remarkable Job of Boring.

In 1892 the Post office Department decided to make experiments looking to the rapid transmission of mail matter by pneumatic or electric power and the government accepted the proposition of the Pneumatic Transit Co., of New Jersey, to install a trial plant under its system in Philadelphia. A double line of pneumatic tubes 6½ inches internal diameter was laid between the Main Post-office at Ninth and Chestnut streets and the East Chestnut Street Postal Station, a distance of about six-tenths of a mile, with receiving and transmitting apparatus at each end.

The line was formally put into service February 17th, 1893, and has been in successful operation ever since, daily carrying large quantities of mail matter.

It had been the desire of the company to have its tubes, which were to be wrought-iron calamined pipe, laid in the streets by December 1st, 1892. However, when the pipe was ready for delivery in the early part of November it was found not to come up to its requirements, and the engineer of the company, Mr. B. C. Batcheller, found it necessary to condemn the whole lot.

In this dilemma he proposed to try having common six inch water pipe bored out smooth, and with this in view applied to some twenty of the largest machine works in and about Philadelphia. Only about eight or ten of them, however, were found who could aid in the undertaking, and with the methods proposed the estimated time for doing the work was from four to six months, distributing the work among them all. At this time A. Falkenau, whose shop is located at Eleventh street and Ridge avenue, Philadelphia, was building the receiving and transmitting apparatus for the terminals of the line. Hearing of the difficulty in which the company found itself he offered to undertake the whole job himself. This was on November 7th, and on November 8th he took the contract for the work.

The method of boring decided upon was a radical departure from any of the ordinary methods in common use. Twelve special machines were accordingly built, and the whole work of designing these machines, building them and boring out nearly 6,500 feet of six-inch pipe was accomplished between November 8th and December 31st, 1892.

A short description of the methods employed will no doubt prove interesting. The problem was to bore out common six-inch water pipe in twelve feet lengths to six and one-eighth inches diameter, to counterbore the bell end and turn down the small end for the purpose of making accurate joints.

The first thing determined on was the rejection of the idea of boring proper and the adoption of the plan of reaming. As it was not essential to have the bore absolutely straight the machines were constructed with a view of allowing the reamer or cutter-head to follow the bore of the pipe instead of being rigidly guided in a straight line.

Time being of the utmost importance the plant had to be designed so as to be as simple as possible, and to use, as far as possible, standard commercial articles, twelve cut gears and pinions being ordered and received from the Brown & Sharpe Mfg. Co. within a few days, the bearings of the machines being ordinary boxes, the spindles of common shafting, and the fourteen foot feed-screws cut from rough stock in a bolt cutter.

Twelve pipes were to be bored at one time, and for this purpose twelve pieces of one and fifteen-sixteenths inch shafting, eighteen feet long, were fitted with cutter-heads at one end. They were splined the whole length and could be slid through a gear wheel with a feather acting as driver. This was driven by a short shaft having on it a pinion and a pulley with a rude clutch for throwing out of gear. The cutter-head, see Fig. 1 (page 2), was of cast-iron seven inches long over all, five inches of it being covered by a wooden guide block. The cutters were four in number and so shaped as to give a reamer edge varying from two and a quarter inches

to one and a half inches in length, as the cutters shortened by grinding, the front end being rounded over to take the cut. Thus the front edge of the cutters formed the rough cutting tools, while the rear portions reamed out the pipe. The feed was made by pulling the head through by a screw attached to the front end of the cutter-head by means of a collar. This screw was splined its whole length to keep it from turning and passed through a support which was clamped centrally to the small end of the pipe itself. The feeding was done by a man turning a hand-wheel with a threaded hub, thus pulling the screw with its attached cutter-head and driving bar through the pipe. The whole arrangement was mounted on heavy wooden sills bolted to the floor, the driving gear resting on two of these sills, while the pipes to be bored rested on two others. The cut was started from the bell end of the pipe which was supported in a bearing enabling the pipe to be readily adjusted to the center line of the bar while the back end of the pipe merely rested in a V-block and was clamped down without any further adjustment. In this arrangement the flexibility of the bar permitted the cutters to follow the bore of the pipe, thus taking an equal cut all around, and it did away with the necessity of accurately setting the pipe, except at the bell end where the cut started, as in this position the boring bar overhung its bearing only about eighteen inches.

As mentioned above the order was taken on Tuesday, November 8th, and the designing of the machines and purchasing of the material at once proceeded with, and on Friday, November 11th, a gang of men was hired to clear out a part of the shop for the work. From Saturday, November 12th, until December 17th, the shop ran continuously without stop, Sundays included. After that it was run day and night but not on Sundays. The first machine was got ready and first pipe was started to ream about 9 P. M. Tuesday, 15th, a week after receiving the order, within which time the details of the plant had been worked up, the plant built and in the main erected. The second machine was started 6.45 A. M. on the 16th, and the others at short intervals thereafter. Each machine was furnished with two cutter-heads in order to avoid stoppages so far as possible. Varying with the hardness of the pipe it was necessary to withdraw and sharpen cutters from two to six or seven times. At first it was attempted to run through the softer pipes without change of cutters, but experience showed that better time was made in boring and that the cutters had longer life by withdrawing and sharpening. The time of boring varied from six and a half to about twenty-four hours while some of the pipes after boring a little distance were thrown out altogether as being too hard to bore. It was noticed also that as a general thing the inside of the pipe was harder than the outside, so that some pipes, apparently soft as indicated by a file test on the outside, turned out quite hard to bore.

The pipe furnished was the ordinary quality of water pipe which is made without any idea of machining at all, and was on the average of very hard iron. In all cases the bell end of the pipe was softer than the bead end, which was due to the method of casting, the pipe being cast with the small end down and the mold resting on an iron plate. The metal on the average was free from blow holes, but when they did occur they were greatest in number at the bead end. At the start the average time for boring a pipe was about eighteen hours, while near the latter end of the job it was about thirteen to fourteen hours.

The wooden guide blocks on the cutter-heads were made out of the dryest lumber obtainable, some being made of cherry, some maple and some ash; none of the lumber used was less than five years old; but the blocks unavoidably shrank and wore in passing through for the first time from one-thirty-second to one sixteenth inch in diameter.

The first ones were made in one piece, glued up out of two and a half inch lumber and they invariably split in shrinking, the iron shank of the cutter-head preventing them from closing in. The later ones were made in four pieces which prevented their splitting in shrinking and also enabled them to be packed out to size again.

The clearing out of the chips was an important problem. On account of lack of available space the boring could not be done vertically and an air blast was determined on to blow out the chips. A positive pressure blower or compressor was first talked of, but was abandoned for a No. 4 Sturtevant fan, giving about seven ounces of pressure, because it could be more quickly obtained and set up. This answered very well for clearing out the chips and for keeping the cutters cool, but if the higher pressure could have been used, as first intended, the cooling effect would have been better yet. The fan was suspended from the ceiling and a sheet-iron pipe carried the air along the ceiling over the tops of the driving heads of the boring bars. At each one of these a piece of hose was connected to the air pipe with its lower end closely following the cutter-head in its progress through the pipe being bored. The wooden guide blocks on the cutter-head were grooved longitudinally permitting the air to pass through and carry the chips before it.

A further problem presented itself incidentally. It was found that the action of the air blast had the effect of winnowing the graphitic carbon dust from the iron and the light dust so permeated the air that it proved a nuisance for the entire block in the neighborhood, a number of valuable book bindings being destroyed in a bindery. This was remedied by the use of suction fans and also by screening the warm air which passed out of the windows through moist flannel cloths.

We present an engraving which gives an idea of the general appearance of the plant while at work. The undertaking called for prompt action, readiness in resource and skill. It was successfully carried out; the pipes were smoothly bored and laid in place as fast as finished.

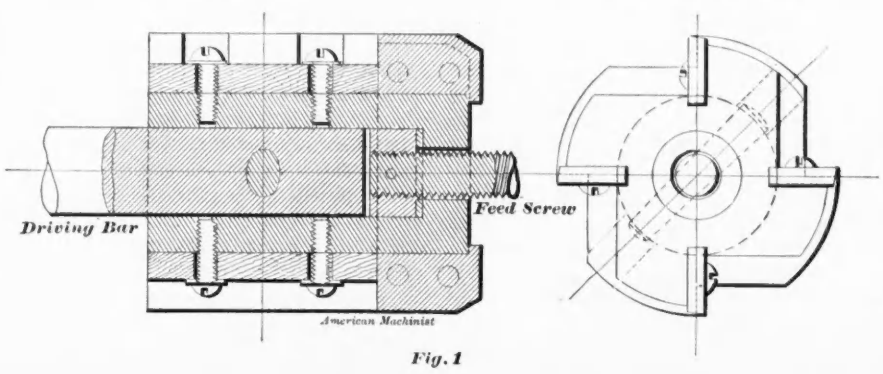
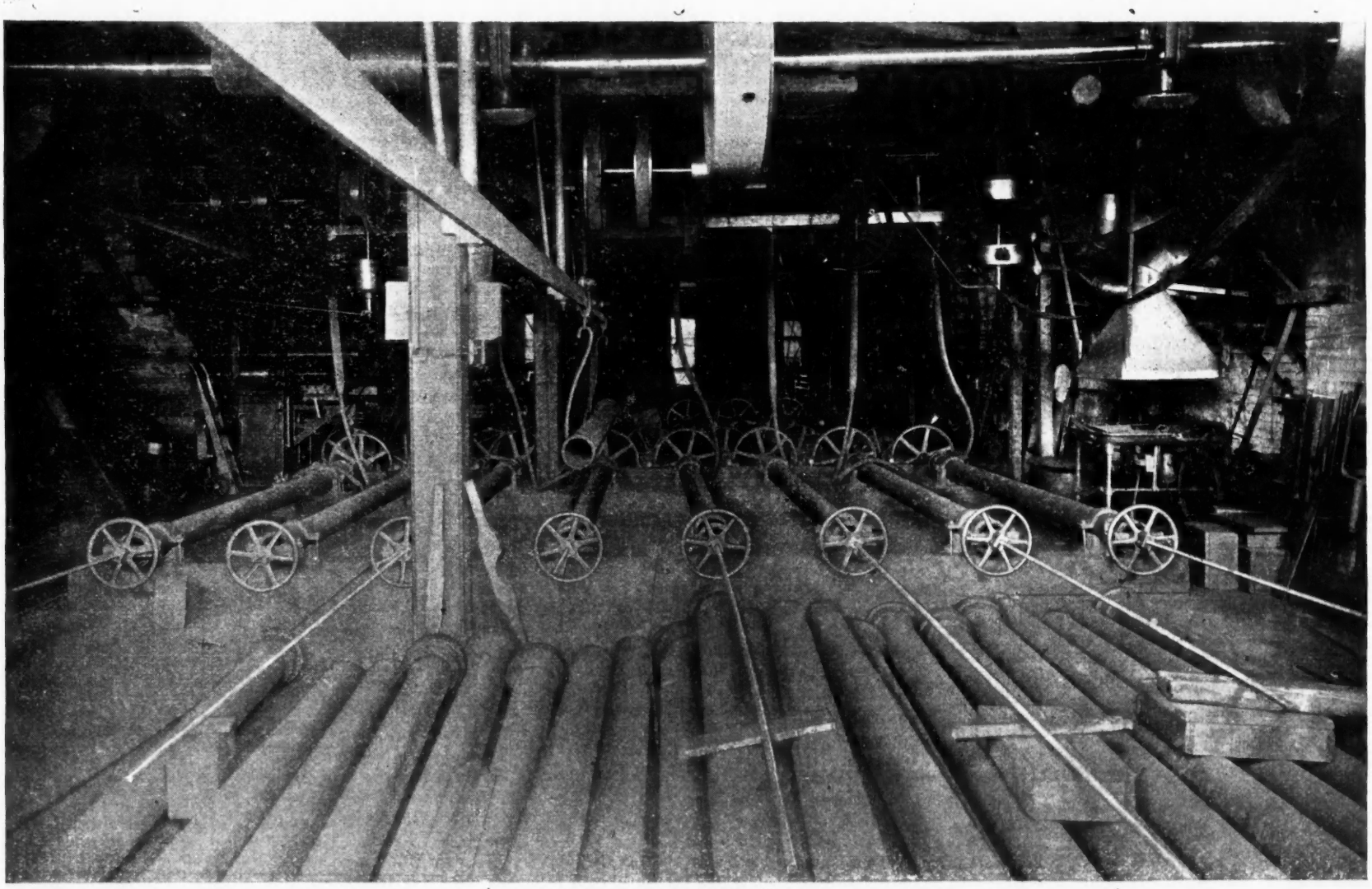


Fig. 1



A REMARKABLE JOB OF BORING.

The decline in what are called industrial stocks, during the month of May, was about $70,000,000, and this, strange to say, produced no great disturbance in the financial world, and at the time had, indeed, but little effect upon confidence in investments. One reason of this is no doubt in the element called "water" in these stocks, that is, an inflated nominal value to diffuse and excuse earnings. If a person has shares of the kind, one-half of which are "water," a shrinkage to that extent is borne with equanimity, because the real value, the one paid for, remains intact and nothing is lost to holders who do not speculate. The fact is, the fluctuations of stocks, as is only too well known in California, relate to the gambling phase of the matter and have no real or permanent effect upon the actual worth of industrial shares when rated at their true value.—*Industry.*

Some idea of what it would cost the United States to keep up with European nations in the way of naval matters may be had from the fact that the French Government will put under construction in 1894 thirty-two vessels, from those of 11,000 tons armed with 11.8 inch guns to torpedo boats, and having speeds of sixteen to thirty knots. It is throwing away a good deal of money, but then it is modern civilization.

One of the more recent uses to which aluminum is being put is in filling teeth, for which it is said to be excellent.

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Headquarters at the Fair.

During the continuance of the Chicago Exposition the AMERICAN MACHINIST will have its headquarters in the space allotted to the Mechanical Press in Machinery Hall. The exact location is Section No. 27, Column K 37. Word can be left with the attendant there by any one who is desirous of meeting a representative of this paper, who may at the time be engaged elsewhere on the grounds.

Status of Engineers.

It seems doubtful, especially when the degree of interest taken in the various congresses which have preceded it in Chicago is considered, whether the Engineering Congress which is to convene the last day of this month will take up in an effective manner the question of the improvement of the status of the engineer, a subject brought into discussion by the presentation of Mr. H. F. J. Porter's paper, presented at the meeting of the A. S. M. E. last fall.

Mr. Porter, who at present is Assistant Chief of the Department of Machinery at Chicago, and has been connected with the mechanical engineering work there in such a way as to give him good opportunities for observing how mechanical engineers and the science of mechanical engineering have been, to use an expressive colloquialism, "turned down" at Chicago, the contrast between their showing there and that of the architects having been very suggestive when taken in connection with the fact that architects have what might be called a very strong professional union, the principles governing this being in all essentials precisely the same as those which govern most trades unions. When the Chicago Fair was projected, it was found that its architectural work there would necessarily have to be done by members of this professional union, upon the terms and under the rules fixed by it. The world acknowledges that this work has been admirably done.

With mechanical engineering it has been different. In this there is no such thing as a fixed minimum fee for services or advice; no rules or code of ethics, and, in fact, little or nothing to protect members of the profession from the effects of unrestricted competition for work which is done for persons who are usually totally unable to discriminate or judge as between the value of the services of different men professing to be engineers. It is the same with some other branches of civil engineering, and many think that the meeting of the Engineering Congress will be an excellent occasion for taking up the subject, discussing it, and perhaps appointing a committee composed of members from the various branches to investigate the matter and report a plan of procedure.

Since the foregoing was written we have received a communication on the same subject from Mr. C. L. Redfield, which will be found on another page, and to which we invite attention. There is, undoubtedly, as we have had occasion to know before this, considerable feeling in the matter. Whether this is sufficiently crystallized to make an impression at the Chicago meeting remains to be seen.

Secretary Hutton announces the programme of the Chicago meeting of the American Society of Mechanical Engineers, which will constitute the sessions of division B of the Engineering Congress. The sessions will be in the Art Palace, Lake Front Park, beginning Monday, July 31, and ending Saturday, August 5. The secretary says: "There will be no hotel headquarters as such, but the secretary and the greatest probable number of members in one place will be at the Raymond & Whitcomb Grand Hotel, Fifty-ninth street."

It is said that about four per cent. of the male population of the United States are color blind.

Jacketing and Compression.

There are perhaps few questions connected with steam engineering that are involved in more obscurity and doubt than that of the advantage or disadvantage of the steam jacket for engine cylinders.

It would at first sight seem to be an easy matter by a few experiments to determine definitely whether or not the jacket results in economy of fuel; but in practice it has not proven so easy, many experiments and exhaustive tests, resulting in equally exhaustive papers, having shown that the jacket is without influence upon economy; that it causes a decided saving in fuel, and that it causes a loss or waste of fuel, the result being, naturally, that engineers are much in doubt about the matter.

The Engineer, of London, in discussing this matter, refers to a recent investigation of the matter of compression by Mr. D. K. Clark, in which he shows that under ordinary circumstances the work given out by the re-expansion of steam is not equal to that required to compress the same steam, and that it cannot be. Just here is where our contemporary thinks the value of the steam jacket comes in by heating and drying the compressed steam, and from this the conclusion is drawn that jacketing ought to prove advantageous where there is considerable compression, and of no value where there is no compression.

In the case of the Pawtucket pumping engines where the investigations of Profs. Denton and Jacobus have shown jacketing to be of no advantage there is practically no compression, and a number of similar results with engines having no compression have been obtained both in this country and in Europe, while with high-speed engines, requiring compression for smooth running, the steam jacket has nearly always proven of some advantage in point of economy. Of course no engineer believes that the varying results obtained by the use of the steam jacket are due to mere chance.

If in one case the jacket is an advantage there is a reason for it, while it is equally certain there must be a reason for its failure to give any advantage in another case.

If a direct connection can be established between compression and jacketing, then we shall be in a fair way of knowing under just what conditions it will pay to jacket a cylinder and under what conditions it will not pay.

If it is shown that the advantage of jacketing depends in some way upon compression, then the next thing will be to determine the degree or amount of compression that will justify jacketing, and under what conditions it is best to jacket the sides only; or the heads only; or both.

The truth regarding the matter can probably be best arrived at by the record of experience of many engineers with many engines running under different conditions, but that the truth respecting the advantage or disadvantage of jacketing will eventually become known we think there can be little doubt.

There is just about as much difference in railroad corporations as there is in individuals, in some respects at least. For instance, while some are rather urging their men to accept free passes, and making arrangements whereby they can live in Chicago at a reasonable rate, others are curtailing the ordinary pass courtesy. Again, others are giving their men a vacation of two weeks, with pay. In some instances, notably in that of the New York Central, sleeping-car accommodations are free and meals are served at half price. It is undoubtedly good policy for any railroad to be liberal with its workmen in this matter, but it is pleasant to believe that the consideration on the part of railroad companies that are liberal in this respect is not one of dollars and cents entirely.

It is very properly pointed out that the World's Fair National Commission did a rather ungraceful thing when at a recent meeting it voted against a reduction of the price of admission on Sunday to 25 cents in order to better enable poorer people to attend on that day, while at the same time considerable energy was displayed in an effort to secure free passes, not only for the members of the Commission, but for their families as well. In other words, the members showed themselves willing that workingmen who are unable to attend on week-days shall pay as much for themselves and families for seeing less than half of the show, as other people pay on week-days for seeing all of it, while they themselves, though presumably abundantly able to pay for themselves and families, want free admission. The temptation to use strong terms in characterizing such an exhibition of selfishness is a very great one.

There is a good deal of outcry in Brooklyn over the killing of children by the electric cars. The motor men complain that to make the trips required of them they must take advantage of every chance to get their car ahead, and that the constant tension under which they are kept in their efforts to make their time on one hand and to avoid accidents on the other, coupled with long hours, strains their nerves almost beyond endurance. Looking fairly at it, motor men in crowded cities must work under a nervous strain that few can appreciate, and their hours of work should be correspondingly short.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(350) R. S. A., Vineland, N. J., asks: Have you any book treating on japanning, showing how to construct the ovens, etc., or have you any back numbers treating on the same subject? *A.*—We have not seen any book which treats on the above, neither have we published anything treating on the construction of ovens, etc, used for japanning.

(351) T. A. C., Syracuse, N. Y., writes: A young man, very anxious to obtain a technical education, has not the sufficient means of carrying him through a course in a technical school. What course should he pursue to obtain an education in mechanical engineering? *A.*—Follow the course indicated in our issue of February 19, 1891.

(352) G. C. W., Claremont, N. H., asks: What treatise on steam and designing steam working machinery would you recommend to a beginner or an apprentice, and where can such be obtained? *A.*—"Text-book on Steam and the Steam Engine," by Prof. A. Jamieson, we believe to be as good as any work published on this subject. You can obtain this from any dealer in scientific works.

(353) E. D. M., Brooklyn, N. Y., writes: If you will consult Unwin's Elements of Machine Design (eleventh edition) page 359, you will learn that you are wrong in your answer to Question 330 in your issue of July 6. I have had experience with worms and wheels laid out both ways, and have obtained superior results by the Briggs' method. *A.*—We see nothing in the book referred to that would cause us to change our answer, which we believe is correct.

(354) H. S., St. Louis, Mo., writes: Please inform me where, and at what price, I can get some books treating on door locks and locksmithing. *A.*—The literature on this subject seems to be scarce. "Construction of Door Locks," by C. Tomlinson, may be of use to you. This you can obtain from any dealer in scientific works; the addresses of some of these are given in our advertising columns. Write to them for price; we do not deal in books.

(355) W. A., Long Island City, N. Y., writes: Kindly state the average number of revolutions made by screw propellers of first-class Atlantic steamers when going at their fastest speed; also the diameter of propellers usually employed by such vessels and the number of blades most approved of. *A.*—The number of revolutions of screw for the different ships vary considerably, from 60 to 90 per minute. The di-

ameter of screws also vary from 18 to 22 feet. Four blades are generally adopted.

(356) P. G., Limestone, N. Y., writes: Please inform me how to get the best results in burning wet tan bark under steam boilers. *A.*—Probably as good a way as any is to extend the brickwork of the cylindrical boilers beyond the front ends so as to obtain comparatively large furnaces; these are covered with an iron plate having suitable openings leading into the furnaces. The wet bark is placed on the iron plate so as to dry it to some extent before it is allowed to drop on the grate.

(357) C. H. S., Seattle, Wash., writes: Please give me the name of any book or books that treat on the design and construction of steam launches—a book of recent date. *A.*—We do not know of any book treating particularly on the above subject that we would care to recommend. The "Manual of Marine Engineering," by A. E. Seaton, treats on the designing, construction and working of marine machinery of comparatively large size, but the rules given in this book can also be used, with very slight modifications in a few cases, for designing launch engines. This book is recognized as a standard work on marine engineering, and we do not hesitate to recommend it.

(358) H. E. W., Brooklyn, N. Y., writes: Please inform me where I can find a complete practical work on the calculation of gears for screw cutting. *A.*—"Applied Mechanics," by Prof. A. Jamieson, has several pages devoted to this subject. "Formulas in Gearing," published by Brown & Sharpe Manufacturing Co., Providence, R. I., also treats on this subject. Both books are useful ones to have, and you can obtain them from any dealer in scientific works. 2. Where can I find a cheap slide rule? *A.*—You should be able to find them in any good hardware store. We are not in favor of using cheap slide rules, as such are liable to discourage rather than encourage their general use. We should advise you to get a good one, for instance such as are made by Keuffel & Esser Co., 127 Fulton street, New York, or others equally as good in construction.

(359) R. D., Cleveland, O., writes: In your answer to my Question 286, June 8, you misunderstood me or I did not explain as I should have done. I would like to know how the crown sheet of a copper fire-box is fastened to the outer crown sheet, as it is sometimes difficult to keep the tubes from leaking after being in use awhile. *A.*—The manner of bracing a copper furnace crown sheet is the same as that adopted for bracing an iron crown sheet; that is, crown bars may be riveted to the furnace crown, and then braces run from the crown bars to the outer crown, or radial stay bolts may be used for connecting the two crowns. When radial stay bolts are used the furnace crown should have considerably more curvature than when crown bars are used, so as to obtain a good thread in the stay bolt holes in the inner and outer crowns. The manner of bracing has no influence on the leakage of flues.

(360) W. V. W., Brooklyn, N. Y., writes: Please inform me how to obtain a good black color on brass, for instance, such as found on surveying instruments. *A.*—The following solution is recommended for obtaining a deep black color on copper and its alloys: Copper nitrate, 100 parts; water, 300 parts. The article, if large, is painted with it; if small, the article may be immersed in the solution. It is then heated over a clear coal fire and lightly rubbed. The article is next placed in or painted with a solution of the following composition: Potassium sulphide, 10 parts; water, 100 parts; hydrochloric acid, 5 parts. This composition need not be used in all cases. Small work can be much more conveniently treated by immersion in the solution first given, and after training off or shaking off the excess of the solution to heat the work on a hot plate until the copper salt is decomposed into a black copper oxide. It would be difficult to heat large articles upon a hot plate, a closed muffle furnace should give better results than an open coal fire. In any case the heating process should not be continued longer than is necessary to produce the change mentioned above.

(361) H. R., Trenton, N. J., writes: Enclosed please find sketch of a mill which is causing trouble by its bearings heating. The speed of the shaft is 2,600 revolutions per minute. It is in line and level. The bearings are of magnolia metal and well lubricated. The mill is placed in a building that vibrates considerably. I claim that the mill is not properly constructed, the driving pulley should be placed between the bearing and the mill so as to be closer to its work; the bearings which are now 6 inches long should be longer, say 8 or 10 inches. The shaft is now 2 inches in diameter. I believe it would be better if it was 2⅛ inches in diameter to allow for truing up when needed. Can you recommend a better metal for the bearings? Please give me your opinion. *A.*—You have not given us any data of importance to base an opinion on. In the first place we do not know the amount of work the machine has to do, neither do we know the pressure on the bearings. According to your sketch the driving pulley is placed close to the bearing on the outside, and, as far as we can judge from the meager data and poor sketch given, we see no advantage in placing the pulley between the bearing and the mill. The heating of the bearings seem to indicate that they are too short, and you are probably correct in your conclusions. Magnolia metal is said to be very suitable for bearings by those who have used it. Before the construction of a machine is criticised it should be known what work it has to do, and the stress in its different parts computed by which a faulty construction can be detected and corrected. Guess-work or mere opinions do not generally amount to much and may lead to false impressions.

(362) W. B. H., Brooklyn, N. Y., writes: Kindly inform me how to prepare blueprint paper so that it will be fit to use for several days without spoiling. I have made blue-print paper for a few years, and have made some excellent prints, but I cannot keep the paper for use over two days, after which the white lines have a bluish tint. I have asked old experienced hands for information, but it seems to be a difficult matter to get them to tell me. *A.*—Dissolve 2 ounces of citrate of iron and ammonia in 8¼ ounces of water; also dissolve 1⅛ ounces of red prussiate of potash in 8¼ ounces of water; when the two are dissolved, mix them in a dark bottle, and keep in a dark place for future use. The paper, which should have a comparatively hard surface, is coated with this solution; to do so, use a sponge dipped into the solution, and then draw the sponge lengthwise and crosswise on the paper, so that the paper will receive an even coating, and hang it in a dark-room or closet to dry; when dry keep the paper in a dark place. It is of the greatest importance that the chemicals should be fresh, and the bottles in which they are mixed should be perfectly clean, and during the time the paper is being prepared it should be exposed as little as possible to the light. If you follow these instructions you will have no trouble in keeping the paper in good condition for blue printing for several weeks. We have used a considerable quantity of paper prepared as above, and found no trouble in keeping it.

(363) B. S., Delaware, Ohio, writes: Please give me a solution of the following problem: I have two vessels, one of 300 cubic inches with an internal pressure of gas of 100 pounds per square inch, and another vessel of 700 cubic inches with a pressure of 40 pounds per square inch. I connect these by a pipe, but the volume of this pipe is not to be taken into account. What will be the resultant pressure when the gas is allowed to flow from one tank into the other? *A.*—Multiply the pressure in one vessel by its volume, also multiply the pressure in the other vessel by its volume, add the products and divide this sum by the sum of the volumes of the two vessels, the quotient will be the resultant pressure. Or in symbols, let P = the pressure in the small vessel, v' = its volume; P'' = the pressure in the large vessel, and v'' = its volume; P = resultant pressure, we then have,

$$P = \frac{(P' \times v') + (P'' \times v'')}{v' + v''}$$

from this we get,

$$P = \frac{(100 \times 300) + (40 \times 700)}{300 + 700} = 58 \text{ pounds.}$$

2. To be correct must I include the atmospheric pressure? *A.*—Yes. The pressures taken above are absolute pressures, that is, the pressure as indicated by the gauge plus the atmospheric pressure (14.7 pounds per square inch). In the above computation we have assumed that the temperature of the gases in the two vessels are equal, and that this temperature does not change during the flow of gas from one vessel to the other, and that the tensions are inversely proportional to the volumes of a given mass of a perfect gas. This will be recognized as the law of Mariott.

(364) P. J. F., Beaver Falls, Pa., writes: In regard to answer to Question 316 in your issue of June 22, you state; "Assume that the weight to be lifted (35 tons) is concentrated in a single point a directly over the center of the left hand strut, the first step will be to find the reaction at c. To do this multiply the distance from a to b by the weight to be lifted, and divide the product by the length of span L; thus, $\frac{28 \times 35}{42} =$ 23.33 tons." This you represent as the compression on the strut at a, it being the reaction at c. Is this correct? And is not the compression on the strut 35 tons, which is equal to the reaction at b and c, equal to 11.66 + and 23.33 + tons, or the total load? Have you not overlooked this fact of the strain in the horizontal belly rod? *A.*—You are right in saying that the compression on the strut, under the conditions named, is 35 tons, but you must have misunderstood our answer, for nowhere did we say that 23.33 tons is total compression in the strut. In computing the stress in the truss rod under the conditions named, we have to deal with the reaction of the support c only, and not with the total compression in the strut. You evidently agree with us that the reaction at c is 23.33 tons. Now suppose this force is laid off on a vertical line through c, and through the extremities of this line, which represents this force, lines are drawn parallel to the beam and the tie rod t, a triangle will be obtained precisely similar to the one shown in Fig. 2. Now the vertical line represents the reaction at c completely, both in direction and magnitude, and since the other sides of this force triangle represent the directions in which two other forces act, these same lines must also represent the magnitude of the forces, or the stresses in the beam and tie rod. The reason for making the line C in Fig. 2 equal in length to that of the strut was to obtain a greater simplicity in the computations of the stresses, and by no means did we intend to convey the idea that the line C represented the total compression in the strut. Our answer we believe to be correct.

(365) W. L., Peru, ——, writes: Kindly inform me if it is absolutely necessary to compute the volume of a wedge by the rule usually given in mechanical books. The rule reads: To the length of edge add twice the length of back; multiply the sum into the perpendicular height and this product into the breadth of the back, and take one sixth of the last product, the result will be the volume of the wedge. For example, take the wedge shown in Fig. 1, and let the two ends of the wedge, $C\,B\,H$ and $A\,D\,G$, be parallel, and let $C\,B = 2$ inches; the height $E\,H = 20$ inches; $G\,H = 20$ inches; then according to rule we have,

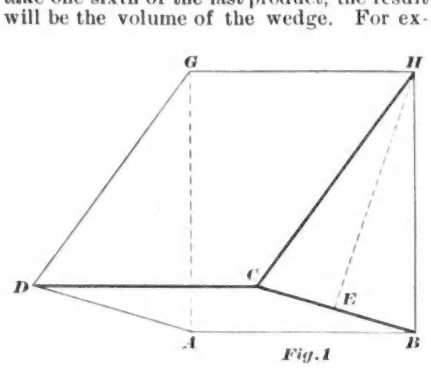

Fig. 1

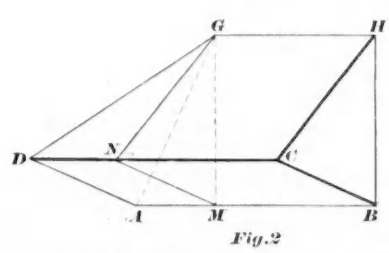

Fig. 2

$$\frac{2 \times 20 \times (20 + 2 \times 20)}{6} = 400 \text{ cubic inches.}$$

I have no doubt that this is correct, but I fail to see why it could not be worked out thus:

$$\frac{2 \times 20 \times 20}{2} = 400 \text{ cubic inches.}$$

If I am muddled up please explain the why and wherefore. *A.*—In computing the volume of a wedge we have three cases to deal with: 1st. When the length of the edge $G\,H$ is equal to the length $D\,C$ of the back; 2d when it is less, and 3d, when it is greater. In the first case, the wedge is a prism, whose base is the triangle $C\,B\,H$, and altitude $G\,H$ or $A\,B$; hence, its volume is equal to the area of the triangle $C\,B\,H$ multiplied by $A\,B$. The area of the triangle is obtained by multiplying $C\,B$ by the altitude $H\,E$, and dividing the product by 2, hence the volume of this wedge having the dimensions given by you will be

$$\frac{2 \times 20 \times 20}{2} = 400 \text{ cubic inches.}$$

From this it will be seen that the volume of a wedge of this kind can be correctly found by the simpler rule, and there is no advantage gained by using the more complicated rule—in fact, to use the latter involves a waste of time and a greater liability to make mistakes. But when we have to deal with the second and third cases, referred to above, the simple rule for finding the volume will fail. Take, for instance, the wedge shown in Fig. 2; here the edge $G\,H$ is less than the length $D\,C$ of the back. Let us assume that the end $C\,B\,H$ is perpendicular to the back $A\,B\,C\,D$. Through G, draw the plane $G\,N\,M$ parallel to $C\,B\,H$, this plane will divide the wedge into the right-triangular prism $G\,N\,M\,B$ and the quadrangular pyramid $A\,D\,N\,M\,G$. Now denote the length $A\,B$ of the back by L, the breadth $A\,D$ by b, the edge $G\,H$ by l, the altitude, that is, a line drawn from the edge $G\,H$ perpendicular to the back, by h, and the volume by V; then, $A\,M = L - l$, $M\,B = l$, and the area $N\,G\,M = \frac{1}{2}\,b\,h$. Now the volume of the prism $= \frac{1}{2}\,b\,h\,l$; the volume of the pyramid $= \frac{1}{3}\,b\,h\,(L - l)$, hence, the volume of the wedge will be,

$$V = \tfrac{1}{2}\,b\,h\,l + \tfrac{1}{3}\,b\,h\,(L - l);$$
$$= \tfrac{1}{2}\,b\,h\,l + \tfrac{1}{3}\,b\,h\,L - \tfrac{1}{3}\,b\,h\,l;$$
$$= \tfrac{1}{6}\,b\,h\,(l + 2\,L);$$

which is the first rule expressed in symbols, and must be used for finding the volumes of wedges belonging to the second and third cases.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's gears, Lex'n, Mass., & Phila., Pa See p. 12.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

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Trade Mark.
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12-inch breech-loading rifled mortar & mounting, w'ght 118,000 lbs., front Gov't B'ld'g, World's Fair; des'n on applica'n. Builders Iron F'dry, Prov., R. I.

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"Binders" for the AMERICAN MACHINIST. Two styles the "Common Sense," as heretofore sold by us and mailed to any address at $1 00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Things to See at the Fair—Continued.*

FRIEND HEMENWAY: In consenting to your making extracts from these letters, I hope you will take pains to consider whether to repeat what I have to say is going to do any good. As to the things that seem defects in the buildings, you and I will be dead before there are any others built, and they would not be likely to pay any more attention to what "back numbers" had to say next time than they did this. Of course there is consolation in growling, but will it do any good? All exhibition buildings before have been built by engineers, except the Crystal Palace in New York, but the Chicago buildings are practically the work of the architects, except, of course, the great roofs, which more than likely had some engineer at the pencil.

Without the least thing to go by except my own instinct, I do not believe the iron arches

* From a private letter, by permission.

of Machinery Hall are right; that is, I believe the same result could be obtained with less material, and with a more agreeable result. Great engineering works are often ugly, but it does not follow from that, that because a thing is ugly it is therefore good engineering. It is useless for one who cannot make the figures to dispute the correctness of those made by the mathematician, and yet I cannot comprehend how a man can begin to figure until he has determined a base to figure upon, which is a process of reasoning, any more than a doctor can treat a case of sickness before he has determined the disease. And this brings me back to the traveling cranes which probably appear all right, but I think will in the next ten years show more of a departure from present practice than has been made even by the transformation from the square shaft and flying rope to electricity. What I mean by this is that I think there are things done the wrong way—and each follows his predecessor. Certainly at the Exhibition there is nothing to convince me that the last four years has produced any improvement on the Paris cranes. They went, did the business, carried thousands of passengers, and made money, and that is more than can be said of all the cranes at Chicago. Whether it is the fault of the crane builders or buildings, it should be charged to the profit and loss account of our "American superiority," any how.

As to the allotment of space in Machinery Hall to the different tool builders, and the fairness of it. What I may think or say about it can have no bearing now, but perhaps a few words which I can say without prejudice may console some. The large builders claim their space was cut down one third or one half, and in some cases this so limited the opportunity to properly represent their product that they preferred not to show at all. The larger manufacturers who accepted the reduction still have large exhibits, and this question comes to my mind—even though every machine has a novel and meritorious feature, do they get people to see them and have they one-fourth enough representatives to show them off if they did? And, too, there seems to be many rather ordinary machines set up to show scraping, polish and plating, each of which is getting to be common enough, so that setting up common tools to show finish is rather too common. It strikes me that if some of these people had taken up less space and given the little fellows a chance, provided they had as novel and meritorious product, that the Exposition would have been more representative and equally creditable. The big fish were given only half a chance and the little fish no chance at all.

In the way of departures in machine processes the Muskegon machine for cutting key-seats and the application of the pull principle to the shaping machine struck me as the most conspicuous in the American department. If you have not I suppose you will illustrate this shaper; for hoeing off cast iron and doing a good job it ought to surprise the conservative machine tool builder; but it is too near right to sell well for ten or fifteen years yet. The only advantages there are in it are that it will do about twice the work a push shaper of the same nominal size; do it better, and a man can see his work better. The disadvantage is that it is not the way we are used to.

A new thing in the German section is a machine to put the clearance on milling cutters on the general plan used by Brown & Sharpe, with this special about it that was new to me—the machine as readily puts the clearance on a spiral cutter or on the face of an end mill as on any regular gear tooth or twist drill milling cutters. Cutters are shown made by this machine for milling gear teeth half round external and internal cylinders with clearance on side as well as edge—split in halves and notched together so that they can be sharpened on the face and adjusted in thickness by introducing paper. Now I know as well as I want to, that nine-tenths of the mechanics will say this is all nonsense—that Brown & Sharpe cutters are good enough—that cutters don't want any side clearance—and, too, by the same parties who would never think of using an end mill without teeth on the end, while to use an end mill without any teeth whatever on the end would be in accordance with their reasoning. Any way, the machine will put clearance on any kind of a cutter in any way a man wants; it seems to be simple, effective, well built, and I should think worthy of more than a passing notice.

Of course, there are things about the machine that we whould never do; and, too, there are things about it that all our lathe builders ought to adopt, but won't; not because they don't know it is better, but because it is not American and would not sell, though I should think they could project the barrel around the tail spindle an inch at a time, and so work the buyers up to what is right by degrees.

The revolution in machine tools since the Centennial has been in the large advance in the use of milling cutters, and in putting cast-iron as well as brains in the machines.

I can readily recall the time when gun-making machinery was sent to England from the Eastern States, and, later, that the English claimed to have improved upon it. My Yankee associate laughed and said, "Yes, the only mortal thing they have done is to put in more cast iron and make them clumsy." That's exactly what every one of our tool builders have been doing for the last sixteen years, which is more to our credit than sneering at the foreign product. The success or failure in the use of milling cutters depends on the rigidity of the machine and arbor, the secure method in which the work is held, and, what is often overlooked, the absolutely rigid manner in which the work is fed to its cutter. Whether the milling cutter keeps sharp or gets dull is in proportion to the above conditions. Our leading tool builders seem to have grown up to this conviction, as shown by comparing the machines of a few years ago with these exhibits at Chicago. And, too, they have made or are making another stride ahead of the rest of the world—in feeding with the direction of the cut instead of against it, which is, of course, right if a machine has no lost motion, though a surprise to everybody to learn that the cutter will keep sharp just as long cutting over cast iron scale as cutting under it.

Isn't it a wonder that builders can sell these machines with such a departure from common practice, and yet cannot sell a lathe unless it is built on the regulation pattern? JOHN E. SWEET.

Combination Drop Dies.

BY B. F. SPALDING.

When a drop die is fastened into the place where it is to be used, it becomes a part of the piece into which it is fastened. The more firmly it is bedded, the more solid it will become, and hence the better it will fulfill its duties. The union of several pieces is intended to make substantially one, sole, solid piece. If it is a lower die fixed in the drop bed, it becomes a portion of the anvil, and if it is a top die fixed in the hammer head, it becomes a portion of the hammer.

It is exceedingly difficult to unite two pieces of iron together, without welding, so that they will be, as to the effect of impact, as solid as one piece.

If you take the blacksmith's hammer in your right hand, and let it fall on the anvil, it will rebound; if, to prevent this, you stiffen your muscle, and exert your will, and bring it down with all your force, straining against a rebound, you will only induce a stronger reaction. If now you take the flatter in your left hand and let it rest on the pene of the hammer while you let the hammer fall, the hammer will strike flat and dead, without rising at all from the anvil. The flatter and hammer, together, are not as heavy as the sledge, but if you let the sledge fall, face down, upon the anvil it will rebound. You take the hammer again in your right hand, and place your left hand on the pene, where you held the flatter, and now let it fall. Do you stop all the rebound? No, it rises slightly from the anvil, and the tingling of your palm tells what occurred at the union of the hammer and the hand. You are familiar with the facts; every one who has worked in the shop has made the experiments. I mention them only to direct attention to the absolute necessity of making the union between two pieces of metal as compact and unyielding as possible, in order to secure the full effect at the impact of the force due to the blow. Much of it may be dissipated in open joints.

These phenomena convey the suggestion that a falling compound weight, made up of two components, one above the other, in contact, but not connected, strikes first with the momentum of the lower part, and second, with the momentum of the upper part, subject to a deduction for interference of the reaction of the first from the place of impact, which the momentum of the upper part must meet and overcome, before it can be delivered at the same place. When the two parts are connected this interference will be proportionately less as the connections are more compact and firm. No union, short of welding, can be much more intimate than that of a flatter resting on the ball pene of a hammer, and yet we know that the break in the continuity of the substance, which occurs so slightly between these two pieces, makes a break in the continuity of the momentum of the flatter and the rebound of the hammer, otherwise this combination would rebound at one time like the sledge.

When a die is set in a hammer it transmits as much of the momentum of the hammer to the object which is struck, as overcomes the interfering reaction of the die, and if the die is small, in proportion to the weight of the hammer, there will be less of this interference to overcome than if it is large.

If it be desired to strike a blow with a drop hammer that shall not rebound, it is only necessary to arrange a loose weight on and above the hammer, or to have the hammer in two disunited parts, of which two parts the lower one, alone, has connection with the uptake and upholds. The greatest effect of impact, in proportion to the power required for lifting the combined weight, will be given when the weight of the upper part exceeds that of the lower.

Considerable disappointment is sometimes experienced when it is found that adding to the weight of the dies does not proportionately add to the effect of the blow. The remedy is in adding to the weight of the hammer, but relief may sometimes be obtained by getting the dovetailing of the tenon to perfectly match that of the die-seat and fit the keys, so that they will draw the die up, as tight as possible, against the hammer.

But whatever the facts of the case may be in regard to the best method of fastening dies, for the purpose of getting the fullest and best possible effects of the blow, it is well to remember that all things in drop work have to give way before expediency. If it is expedient to fasten dies in a drop in a certain manner, for any especial reason, whether by that means the full effect of the blow is secured, or not, that is the way to fasten them; and if, when thus fastened, the effect of the blow of a certain sized hammer is not sufficient to accomplish the desired object, then a larger hammer may be used. The principle of drop forging is not persuasion, it is compulsion; it requires the furnishing of power, potent enough to overcome every interference and drive the reluctant stock into the dies, where it forces it to assume the form of the impressions.

It is not always necessary to use a piece of steel for a die, which is large enough to make a die-block with a tenon of the size which the bed of the drop requires. The die proper, or the steel block into which the impression is cut, may often be economically made of a much smaller pattern and held in a die-block, as well as have it all solid in one piece. The impressed block can be let into a wrought-iron or steel die-block by drilling and chiseling out a recess in the block, or by planing out again to receive it, or it may have a block of cast-iron cast around it.

When the steel is thus used as an impression block, it is thus employed because its wearing qualities are demanded, and the requisite strength is partially supplied by the material of the block in which it is set.

There has always been a claim in regard to railroad rails that they have two general functions—one to support strain, and one to endure wear; and as it seemed useless to be obliged to renew the whole rail—whose cost augmented with its weight—simply because it failed, in its less massive function, by wearing out, efforts have continually been made to separate these functions, and as the growing tendency of rails is to increase in weight, this consideration has the same tendency to increase in weight.

In some of these efforts the scheme has been to make separate parts, to be permanently laid, for upbearing strength, while other parts, intended for wear, were made as light as was consistent with the purpose, and could be easily removed and replaced with similar parts. Other plans crossed the problem, and had the rail made double-headed, so that either side could be used for wear, while the opposite side always contributed its quota of strength.

Ingenuity in different branches suggests similar expedients; the replacing of the worn part of a rail is parallel with the making of the impression part of a drop die of steel, to resist wear only, and hence making it no larger than will suffice for this purpose, leaving it to derive support to resist stress from the bed in which it sets. The double-headed rail finds its counter-part in a mode of making flat-faced dies which have a square cross section of ample size to resist breaking strain. The object of making them of square cross-section is to use each of the four flat faces to sink impressions in. After the impression which has been cut on one side is worn out, another impression can be cut on either of the other sides, each side serving in turn for a face. If the drop has dovetailed die-seats in the hammer or bed, packing is made of the necessary form, or the keys are modified to suit. Dies with straight sides cannot be drawn up against the seat with keys, nor is there anything but friction to hold them firm in the seat. The time when dies shift in the drop, whether they are dovetailed or straight, is at that instant, succeeding the impact, when the reaction takes place between the die and its bedding, the reaction which tingles the palm of the hand on the pene of the hammer.

The same objection lies against these four-faced dies that is raised against double-headed rails, which is, that while one side is used for a bed, and the other for a face, the bed side gets so bruised that it is not fit for a face, and the face gets so cut and worn that it is not fit for a bed. If the impression is deep, however, it is much less trouble to redress the bruised sides, than to plane away the whole worn impression to obtain, on that one side, a new face.

This plan works better on hammers which are wide between the uprights than on those which are narrow, as the strength of the cheeks—which they much need to resist the excessive strain of keying—is not so much impaired by removing the stock to get the extra width of the die-seat.

In the wide die-seats it is often very convenient to key in an open blocking die alongside the finishing die. These dies are only as wide as the stock is likely to spread in them when worked, and are often the scant profile of the finished forging as their use is for shaping the stock sidewise so that it will drop into the finish imprint. Their durability is not the same as that of the finishing dies, and therefore it is an advantage to have them separate therefrom, in order that the wearing out, or failure of one, may not necessitate the renewal of both. It is the general rule that a pair of blocking dies will outlast several pair of finishing dies.

It is very convenient to have keyed into the die-seat, along with the dies, some kind of cutting-off tools, to cut off pieces which

are made from the bar, after all the work has been done on them which it is desirable to do before they are detached. These tools are liable to accident and require frequent sharpening or renewal, and simple arrangements are easily made for doing it readily.

Pieces which have been blocked out and are detached from the bar as they do not require the impression to go clear across the dies may be dropped in steel impression blocks, or comparatively small dies, which for support are placed in die-blocks of ample strength to resist breaking strain. The wrought-iron or steel die-block, used for this purpose, has a recess cut into it which is of the shape and size of the die pattern it is to receive. In order that this die pattern or impression block may derive any substantial and trustworthy support from the die-block in which it is embedded, it must fit it with an absolute grip on all sides which are liable to be stressed. If it is not so encompassed it is liable to yield to the pressure, which forces it open beyond the limits of its elastic recovery and then a crack will soon make its appearance. Frequently the latitude, commonly described as a "loose fit," will suffice to permit the die to spread beneath the force of the blow enough to crack it. The recess in which the die is held should take it in nearly to its full depth. The die-block should be of sufficient mass to absorb in itself the slight rebound of the die, and it should have no compromise with skill and economy in the matter of its being well fitted and drawn by a dovetailed tenon to its solid bed.

In the matter of holding dies, it is a good thing once in a while to get back to first principles. Some of the old trip-hammers men around Worcester, Milbury, Sutton and other places in the New England States, in the early part of the century, used to make, instead of a slot or gain, a mortise or recess in their hammer heads in which to hold the upper dies. These mortises were perhaps an inch deep, a quarter of an inch smaller at the bottom than at the top, and the dies were made to fit them closely, and wedged in tight as the hammer struck upon them. They were removed by striking them, first on the one end, and then on the other; a very few blows sufficed to loosen them. As long as a man run his own hammer exclusively he could keep his small stock of dies in pretty decent fitting, but when the hammer was of general use, the dies soon became of no use, and would drop out, sometimes, when the hammer was running, so for such hammers, gains were cut and keys used in Lowell, Waltham and Saco, where trip-hammers were employed at making cotton mill spindles and other machinery, work which is hard on dies, and requires that they shall accurately match and retain their position. They soon came in universal use in scythe and gun shops, which were the principal places where the trip hammers were used. Small trip hammer heads are liable to split in driving keys, and when gains or slots were first used they were cut shallow, the tenons of the dies were short, and the keys narrow. The mortise is stronger than a slot, for it holds like a band on all sides. It appears to be the best way to fasten impression dies into the die-blocks.

In *La Reveue Generale des Chemins de Fer*, M. E. Chabal, locomotive superintendent of the Paris-Lyons-Mediterranée Railway, gives his conclusions as to the comparative merits of steel and copper fire-boxes, based upon facts obtained both from his own practice and a study of the subject during a visit to America. He has come to the conclusion that, as regards safety, neither metal has any material advantage over the other. Steel boxes weigh less, as the tube plate when of copper is often 1 inch thick, and the remainder of the box about $\frac{9}{16}$ inch thick. With steel the tube plate is $\frac{1}{2}$ inch thick, and the other sheets about $\frac{5}{16}$ inch. As far as cost is concerned, although copper is much more expensive than steel, it is easier to work, and the labor account is therefore low, and then the scrap value of the copper is considerable, so that taking these two facts into consideration, experience shows the saving by the use of steel to be much less than might have been expected at first sight. As regards maintenance, he states that steel costs more than copper. Steel fire-boxes require greater care, both in construction and maintenance, than copper ones do. They should always be washed out with hot water, as is done in this country.—London *Engineer*.

MANUFACTURES

A company has been organized at St. Martinsville, La., to build a sugar refinery.

Jacob Walder is about to erect another large silk-mill opposite his present one at Paterson, N. J.

The Leonard Bratt Lumber Co., Lester, Ark., is erecting a 40-foot saw-mill, dry-kilns and planing-mill.

J. L. Kinser and J. D. Huddle are to erect a sash, door and blind factory and planing-mill, at Bristol, Tenn.

Swane Bollinger, of the Juniata Knitting mill, of Huntingdon, Penn., is erecting a two-story frame mill, 24x40 feet.

A $100,000 stock company is being organized to erect a cotton mill at Uniontown, Ala., by J. H. White and others.

Lehman, Stern & Co., New Orleans, La., will erect a new building and add new machinery to the Lane cotton-mill.

The Diamond Match Co. will shortly erect an addition at Oshkosh, Wis., 150x38 feet, two story, brick, at a cost of $8,000.

Work has commenced on the enlargement of the Weetamoe Mill, Fall River, Mass. The cost will be in the vicinity of $125,000.

Cameron, Yoakum, Castles & Co., Waco, Texas, are making preparations for the erection of a grain elevator at Midlothian, Texas.

The National Brass Works, Reading, Penn., are to erect two three story additions to the plant, one 60x40 feet, and the other 50x20 feet.

A. D. McFarlin is organizing a stock company for the purpose of erecting a rice-mill of 500 barrels capacity at Savannah, Ga.

The Iron Gate (Va.) Furnace Company intends building a 3-mile narrow-gauge road to connect its mines with the Craig Valley road.

The Pee Dee Manufacturing Company, Rockingham, N. C., will put in 75 looms and other machinery, and enlarge its water power.

A company to build a cotton factory at Covington, Ga., is being agitated by the leading citizens. A capital stock of $100,000 is proposed.

A concern has been formed in West Gardner, Mass., to establish a plant for the manufacture of reed and rattan chairs.

The St. Louis Southwestern R. R. Co. proposes within the next two months to erect car shops at Pine Bluff, Ark., at an expenditure of $75,000.

A large furniture factory is being erected at Stauffer, Pa., by R. R. Canfield, which, when completed, will employ between 25 and 50 workmen.

Wm Adams & Co., of the Hope Iron Foundry, Philadelphia, Pa., will erect a two story brick building, 62x100 feet, in the vicinity of their present plant.

The New York Shoe Company, of Lynn, Mass., proposes conducting a new factory at Ipswich, Mass. When operating it will probably employ 150 hands.

H. F. Merriam is to put up a new foundry at Millbury, Mass., 60x36 feet, one story, with a monitor roof and cupola, and a new machine shop, 56x25 feet.

J. M. O'Donnell & Co., of Brockton, Mass., will occupy the shoe factory formerly operated by Houghton, Coolidge & Co., and will double their capacity.

The National Brass and Iron Works Company will erect a 16x75 foot brick storehouse at its plant at Lebanon, Pa. Other enlargements will also be made.

The Facer Hammered Steel Car and Locomotive Wheel Co. has applied for incorporation. The capital is $600,000. The plant is to be located at Hamilton, Ont.

The Ohio Steel Company, of Youngstown, O., has contracted with the Shipper Bridge Company, of Pittsburgh, for the erection of a dynamo house, and a large pump.

The New England Steel Works, of Worcester, Mass., are to make an addition 50x50 feet to their steel casting foundry, which will greatly increase their output.

G. H. Eaton & Co. have purchased the Jewett saw mill property at Stoneham, Mass., and will remodel it for the building of sheet iron and tin-working machinery.

A new cotton-mill is being agitated at Easley, S. C., and the citizens are manifesting much interest in the project. A meeting will be held at an early date to consider plans.

M. F. and J. C. Rutherford, W. H. Fielding, T. W. Leverett and J. K. Hembree will erect six cotton gin stands, at Pettys, Tex.

The Clinton (Mass.) Wire Cloth Company has had plans prepared for a new mill, 293x80 feet, three stories, to replace the portion of the works destroyed by the recent fire.

The Dwight Manufacturing Company, of Chicopee, Mass., will probably build one of the largest mills in the United States for the manufacture of coarser grades of cotton cloth.

A new knitting mill is projected at Marietta, Ga. Mr. B. K. Couper is to run the plant, which will employ 70 operatives. Cotton knit goods, hose and half hose will be the product.

The Biershenk Company has been incorporated in Brooklyn, to manufacture cabinet work and stairs. The directors are Peter F. Biershenk, Geo. Schmidt, and others of Brooklyn.

The Plano Manufacturing Company, of Plano, Ill., is building a new shop, 500x75 feet, at West Pullman, Ill., and intends employing 1,100 men. At present its maximum is 700 men.

The Toledo Nut Lock Company, of Toledo, O., has been granted a charter, and will engage in the manufacture of nut locks and other mechanical devices. The capital stock is $100,000.

The Empire Wool Cleaning Co. has been incorporated at Jersey City, N. J., with a capital stock of $500,000, for the purpose of cleaning and dealing in wood and manufacturing the same.

Abendroth & Root Manufacturing Company, 28 Cliff street, New York, issue a three-leaf folding circular of the Root improved water tube boiler. The boiler is well illustrated and described.

R. M. Connable, J. M. Connable, John L. Connable and J. H. Bootes have incorporated the Connable Veneer and Lumber Co., at Memphis, Tenn., to manufacture lumber, veneers, etc.

A stock company has been formed at Manchester, N. H., with a capital of $15,000, for the manufacture of shoe findings. The president is F. M. Hoyt. A building will be erected at once.

A. B. Austin, Fort Wayne, Ind., is preparing plans for a new machine shop, 120x50 feet, two stories; a foundry, 80x60 feet; a boiler shop, 140x60 feet; and a blacksmith shop, 50x30 feet, all of brick.

The National Supply Company, of Minneapolis, has been incorporated. The new plant, when in operation, will manufacture all kinds of light and heavy machinery and mechanical devices under patents.

The mill which Mr. P. S. Baker and associates will erect at King's Mountain, N. C., will contain 300 looms. Weaving will be done exclusively. They expect to have the plant in operation by January 1.

The W. F. Baker Carpet Co. has been incorporated at Roanoke, Va., with a capital stock of $200,000. F. O. Rhodes is president, N. T. Nininger, vice president, and W. F. Baker, secretary and treasurer.

The High Shoals Company, of Gastonia, N. C., has been incorporated, to manufacture cotton and wool fabrics. Fred Oliver, R. M. Miller, Jr., and D. A. Tompkins are the incorporators. Capital stock is $50,000.

The Beaton & Corbin Manufacturing Company has been incorporated at New Britain, Conn., with a capital stock of $15,000. The new company will manufacture and deal in floor and ceiling plates for steam pipes, etc.

A cotton factory has been built at Maxton, N. C., and the equipment of machinery is now being placed. The plant will be in operation by August 15, and additional machinery for enlarging the mill in the fall has been ordered.

The Berlin Iron Bridge Co., of East Berlin, Conn., have received from E. D. Leavitt, consulting engineer of the Calumet & Hecla Mining Co., contract for the iron roof over their new engine house. The building will be 80 feet wide and 200 feet long.

The citizens of Sumter, S. C., are in favor of forming a company, with $200,000 capital, to erect a cotton-mill. Major Marion Morse and Mr. M. Ryttenburg are interested. A committee numbering five has been appointed to canvass for subscriptions to the stock.

At a meeting of the stockholders of the Worcester and Millbury Electric Street Railroad Company in Worcester, June 28, it was voted to increase the capital, $150,000 to $300,000. The increase will be used to pay in full the corporation debt of $128,000, and in the further equipment of the road.

Penberthy Injector Co., Detroit, Mich., issue a neat little pamphlet, "As Others See Us," so entitled, we suppose, because it contains commendatory letters relating to the Penberthy injectors from a large number of steam supply houses, manufacturers of traction engines, etc., in the United States and Canada.

Col. James H. Traynham, of Laurens, S. C., has inaugurated a movement at that place for the organization of a company to erect a $100,000 cotton-mill. Over $50,000 has already been subscribed, and work on the buildings will commence at once. Colonel Traynham will probably be chosen president of the company.

Houghton, Hibbard & Warren, East Rochester, N. H., are to remove their shoe business to Somerworth. The new factory will be 200x45 feet, four stories, with accommodations for 500 hands, and is to be ready for occupancy by November 1. The firm removes from East Rochester because it desires more room to extend its business.

The Berlin Iron Bridge Co., of East Berlin, Conn., are building the iron roof on the new purifier house for the Philadelphia Gas Co., at Philadelphia, Pa. The building will be 70 feet wide and 180 feet long, the roof constructed entirely of iron, covered with slate. The new power house for the Worcester Traction Co. will also be designed and built by the same company.

J. A. Fay & Egan Co., Cincinnati, O., have issued a catalogue of wood-workers, variety and universal. In addition to fine engravings of various machines, engravings showing the manner of performing a variety of operations with these machines, position of the hands, etc., are given. This catalogue is intended for general distribution, and will be found interesting to those in any way connected with fashioning wood by the aid of machinery.

The new five-set knitting-mill at Waterford, N. Y., in which the present stockholders of the Waterford Knitting Co. are largely interested, is now under course of erection, the foundations and a portion of the first story being already completed. The main building, 60x100 feet, will be built of brick—four stories high—and a one-story brick addition, 40x100 feet, will contain the boilers, engine, picker and wash rooms. Steam power will be used exclusively, and the mills will be under roof in three months.

The Pope Manufacturing Company's works at Hartford, Conn., are to be enlarged by a building 240x50 feet. The ovens, ten in number, will be in an adjoining building, separated from the main building by a four-foot passageway. The vats for preparing the enamel will also be in an adjoining building. The first floor will be used as a shipping room. The second floor will be used for setting up the frames, and the third floor for setting up the wheels and putting on the tires. The old factory will be torn down immediately, and the contracts call for the new building to be ready for occupancy October 1.

Plans for the new works of the Westinghouse Electric and Manufacturing Company are nearly ready. They are to be built at Briton, Pa., on the line of the Pennsylvania Railroad, about 11 miles from Pittsburgh. About 23 acres will be covered by the new works. The machine shop will cover a space of 750x250 feet, the warehouse 750x250 feet, the foundry 700x250 feet, and the boiler house 150x40 feet. Including other buildings, the area of the ground floor will be 7⅝ acres, and including the second floors 15 acres. The structure will be fireproof, composed of steel and stone. Labor-saving devices will be employed to the fullest extent, and electricity will be employed as a motive power. It is announced that a large number of homes for the use of the employes will also be erected.

Machinists' Supplies and Iron.

NEW YORK, July 15, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.00; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12.50. Southern brands of good quality are obtainable at $13.75 to $14.50 for No. 1 Foundry; $12.50 to $13.50 for No. 2 and $11.75 to $12.50 for Gray Forge.

THE ENGINEER WHO READS

and selects the quality of books he reads is the one who gets ahead in the world. The engineering books at popular prices, published by

The MASON REGULATOR CO., of BOSTON,

are written and recommended by the highest authorities.

Antimony—The market is barely steady. We quote L. X., 10.20c. to 10¼c.; Cookson's, 10.35c. to 10½c.; Hallett's, 9.80c. to 9.85c., and U. S. French Star, 10½c.

Copper—The market continues weak. Some business is reported in Lake Copper, 25,000 pounds having been sold at 10.25c. Casting Copper is held at 9¾c. to 10c., with sales of 25,000 pounds at 9¾c.

Lead—The market is weak. There are offerings at 3.60c., but probably 3.55c. will buy.

Lard Oil—Prime City is quoted at 72c. to 75c.

Spelter—The market is flat at 4.15c. to 4.20c. for New York delivery.

Tin—The market is firmer. Speculative transactions as reported, 60 tons spot at 19.35c. to 19.40c., 300 tons July at 19.10c. to 19.50c., and 50 tons August at 19.50c. to 19.75c. There are bids at 19.40c. for spot.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Position as foreman boiler maker; 12 yrs'. exp.; ref. A1. A. M. P., Box 92, Roanoke, Va.

First class draftsman and machinist wants position. Address Box 249, South Milwaukee, Wis.

An exp'd supt. of machine works and foundry is open to an engagement. Box 33, AM. MACHINIST.

Good draftsman, designer, grad. Polyt'c in Germany; desires change pos. Box 38, AM. MACHINIST.

A competent round die-maker wants permanent situation; state terms & cond's. Box 40, AM. MACH.

Wanted—Position by mech. draftsman; tech. educat'n; shop pract'e; ref. A1. S. D., Box 44, AM. MACH.

Wanted—Position as draftsman by young man with 3 years' shop and 3 years' drawing-room experience. Box 32, AMERICAN MACHINIST.

Wanted—Position by mechanical draftsman and machinist with 8 years' experience in shop and office. Address E. G., AMERICAN MACHINIST.

Foreman pattern maker, age 32, thorough in all its branches, desires situation with first-class concern; best of references. Foreman, AM. MACH.

Wanted—Position as foreman of lathe work or tool room; within 200 miles of Chicago pref'd; exp. man; good reference. W., AMERICAN MACHINIST.

Wanted—A first-class traveling salesman to sell engineer's specialties and steam users supplies Williamsport Engineer'g Supply Co., W'msport, Pa.

A mech. eng'r., capable of laying out plants & making estimates, desires to obtain in N. Y. City the agency from a reliable manufact'r of steam engs, boilers, etc.; cor. solicited. Box 34, AM. MACH.

Member of A. S. M. E. wishes position as supt. or manager of shop or other position requiring technical and practical knowledge of mechanical engineering. Address Box 35, AMERICAN MACHINIST.

Wish to connect myself with firm making various general and special machinery; good work, ability and ingenuity must be appreciated. A1 draftsman; journeyman mach't; good ref. Box 39, AM. MACH.

Wanted—Position by thor'ly competent foundry foreman on high grade work; green or dry sand; engine, machinery or chilled rolls; references. Address "Chilled Rolls," AMERICAN MACHINIST.

Shop agents for Carr's surface gauge and key rule clamps; liberal discounts; send for circulars; 2,000 gauges sold in past six months. The Hoggson & Pettis Mfg. Co., New Haven, Conn.

Young man (25) having had full shop apprenticeship and 4 years' drafting; also tech. grad. desires position with experienced M. E. as assistant; specialty steam eng. work. N. Y. or vicinity preferred. Box 42, AMERICAN MACHINIST.

Wanted—Young man with experience in designing vertical engines, compound and triple expansion; steady employment and a good opening for advancement to the right man. Address with age, exp., and wages expected, Box 36, AM. MACHINIST.

A young man who has worked his way from apprentice to superintendent, with no influence except ability and attention to business, is thoroughly practical, expert on Corliss engs. and heavy machinery, desires a situation. Box 37, AM. MACH.

Draftsman and designer open for engagement in any responsible position. Exp'd in modern shop and drafting room practice, design of special tools, jigs, etc., for mfr. of high grade interchangeable mach'y. Can estimate, supt'd construction & erection. Elec. mach'y pref'd. Box 30, AM. MACH.

Wanted—Position in shop or factory where strict attention to business will bring fair salary and advancement; have been bookkeeper, timekeeper, stockkeeper, paymaster and superintendent; well posted in machinists' hardware; refs. and bond if required; rather be outdoors part of time. Address Z. Q. Z., AMERICAN MACHINIST.

Wanted—A position as tool and die-maker; thoroughly practical and exp'd in designing dies, combination dies, forming dies, special screw machine tools and jigs for turning out large quantities of fine brass work, at the least cost; have had 5 years' exp. in handling help; age 30. Address Box 41, AMERICAN MACHINIST.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Agents Wanted—Scientific Machinist, Clev'd, O.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Turret lathe, $100; screw-cutting lathe 16", $95; vertical boiler, 15 horse and engine, 229, AM MACH.

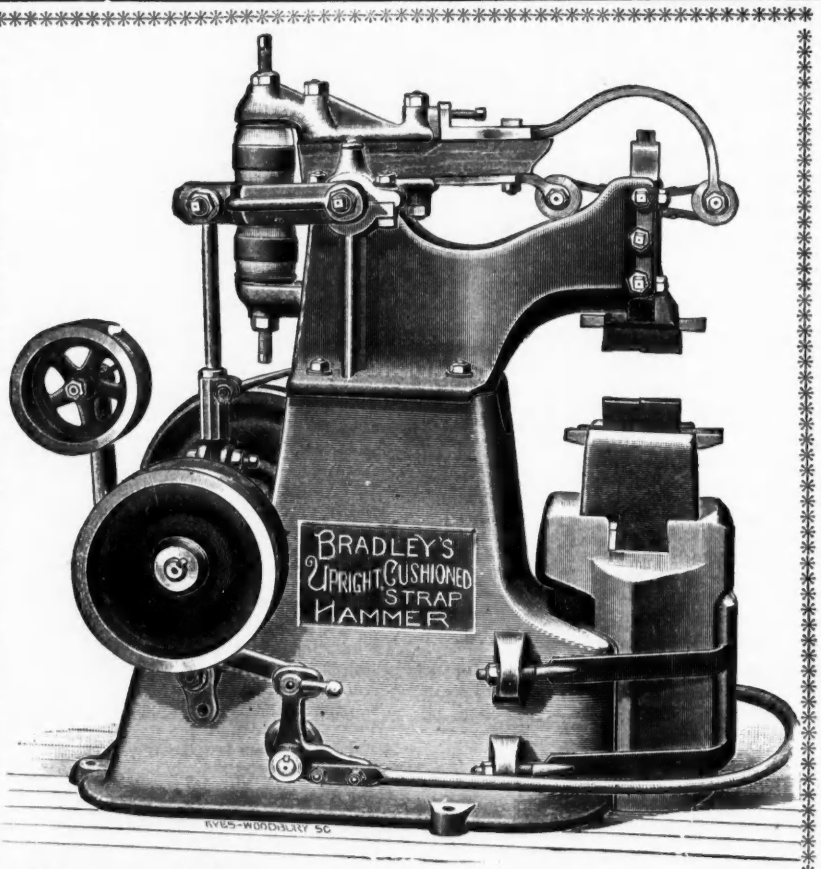
Wanted—Partner in an iron foundry in St. Louis, Mo., with $1,000 to $5,000. Write J. McCash, 619 Harris Ave., St. Louis, Mo.

Rubber, metal, and composition patterns & small rubber and metal work for carding and grouping, to order. John T. Usher, 116 E. 54th St., New York.

Wanted—A large swing screw-cutting lathe; diameter of swing not less than 26" short bed preferred. Address Box 43, AM. MACHINIST.

To manufacturers, patentees, and others having small machines and hardware novelties to build—our improved processes reduce the cost of product'n. H. H. Franklin, 812 S. West St., Syracuse, N. Y.

We will pay 50 cents each for copies of the AMERICAN MACHINIST of December 4, 1886 issue, must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.



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If you plate, draw, square, taper or weld iron and steel, you need a Bradley Hammer.

If you swage, collar, spindle, or do any manner of die work, a Bradley Hammer will soon pay for itself.

That the Bradley is the best Power Hammer in the market has never been questioned. Our circulars illustrate, describe, give sizes and prices.

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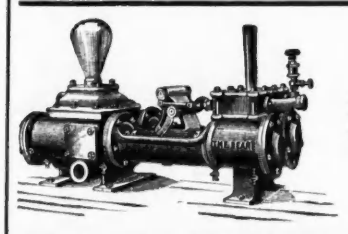

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STEEL FOR Lathe and Planer TOOLS, Cold Chisels, Punches & Dies, Milling Cutters, Molding Bits, &c. SHEET STEEL, POLISHED Drill Rods, SPRING STEEL, Machinery Steel, COILED SPRINGS, Steel Forgings, ETC.

A NEW SCREW PLATE. THE HANDIEST PLATE MADE.

THE FULL MOUNTED LIGHTNING.

These Plates have a stock with each die. The dies are our celebrated Adjustable **Lightning** Dies. Each Stock is of correct length and weight to suit size of die. Several sizes of dies may be in use out of same set at same time. SEND FOR CATALOGUE. Made by

WILEY & RUSSELL MFG. CO., GREENFIELD, MASS., U. S. A.

"R. MUSHET'S SPECIAL STEEL"

SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.

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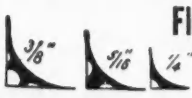

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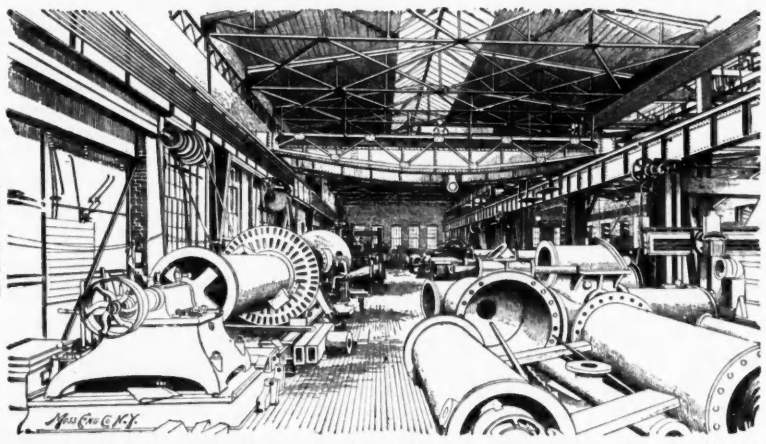

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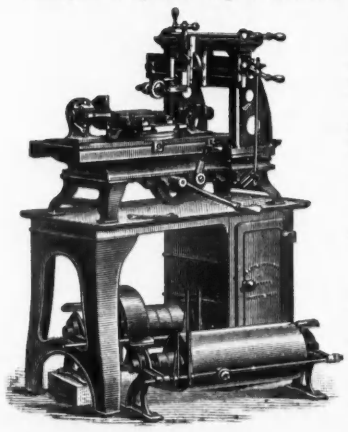

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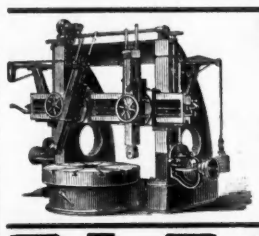

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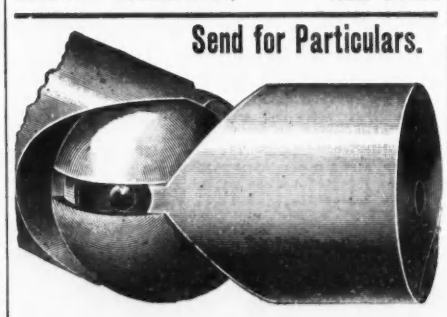

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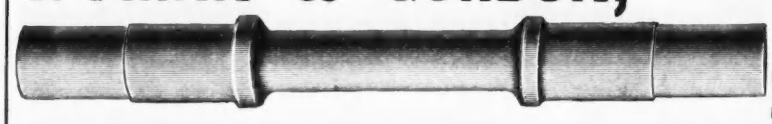

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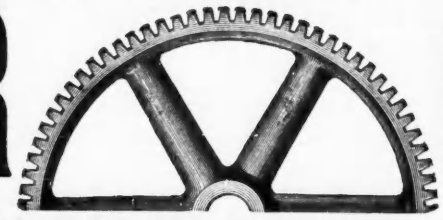

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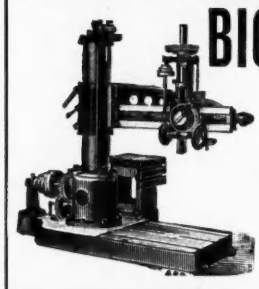

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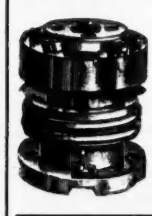

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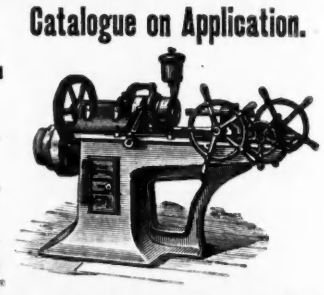

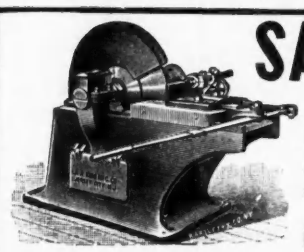

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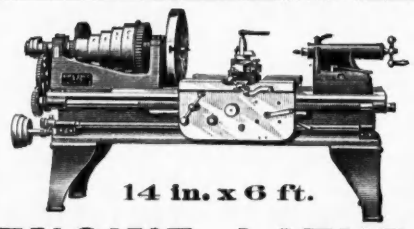

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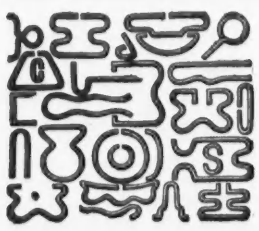

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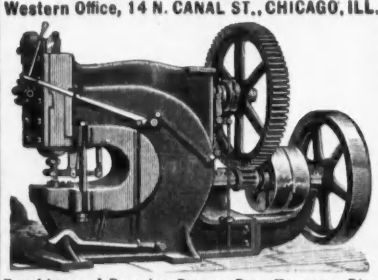

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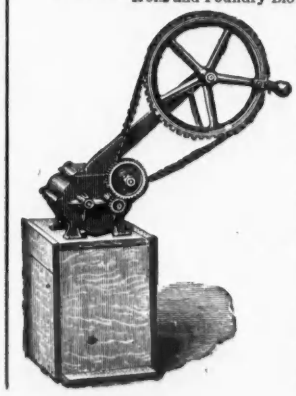

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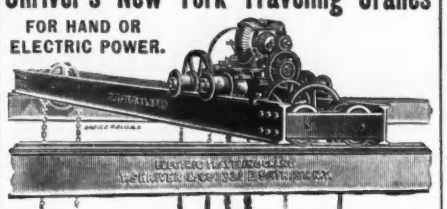

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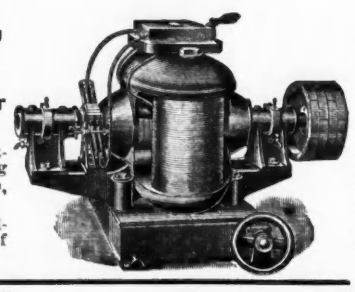

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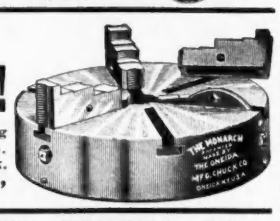

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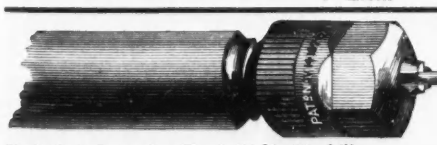

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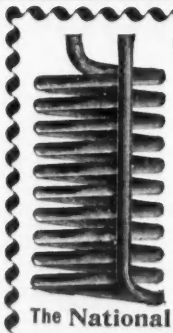

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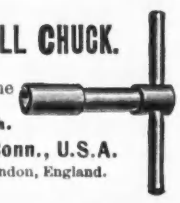

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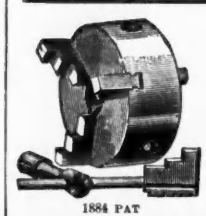

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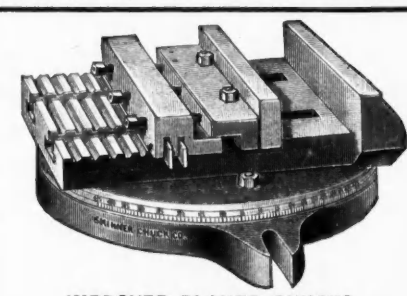

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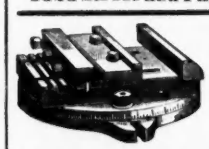

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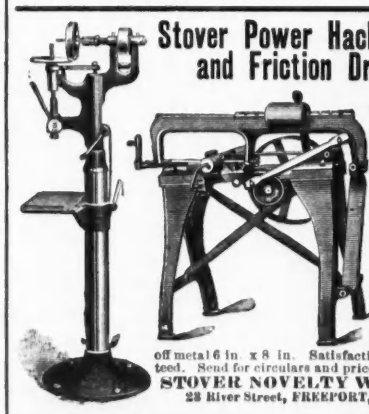

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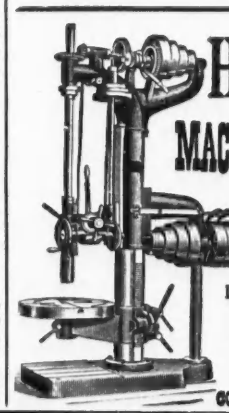

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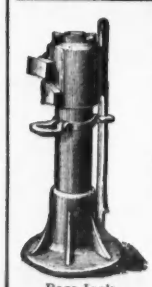

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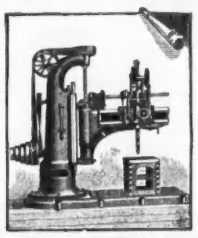

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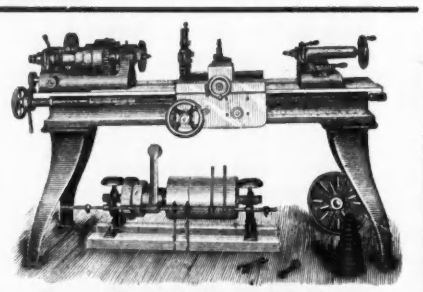

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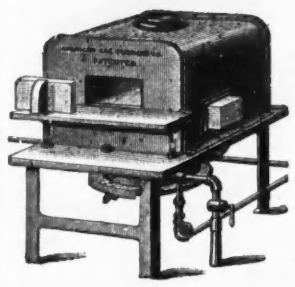

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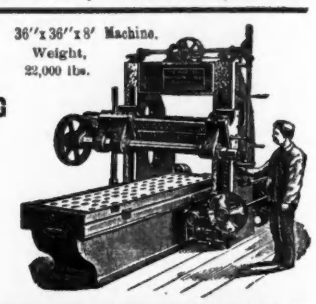

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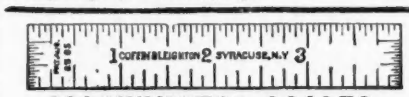

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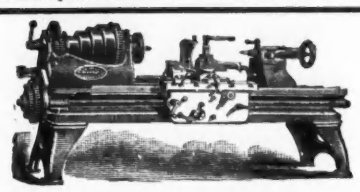

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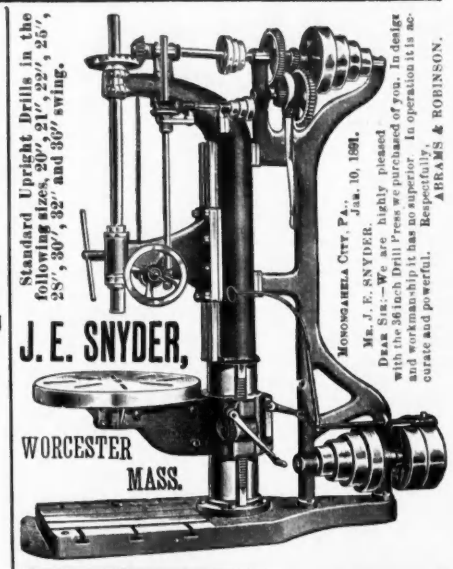

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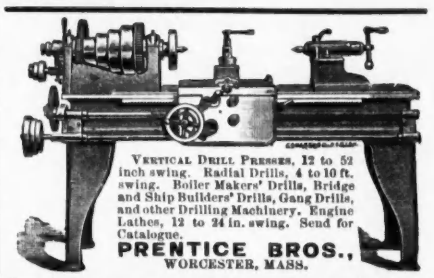

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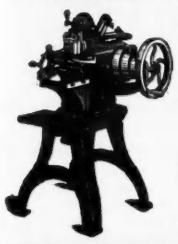

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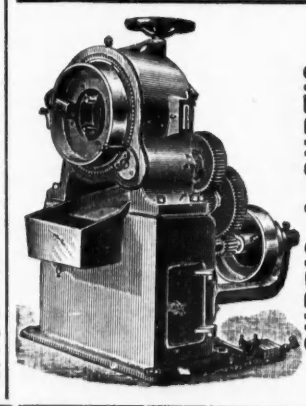

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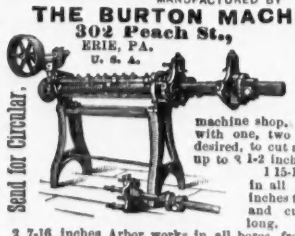

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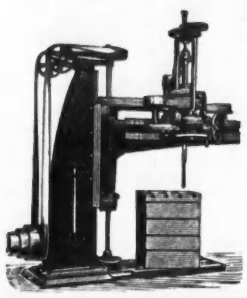

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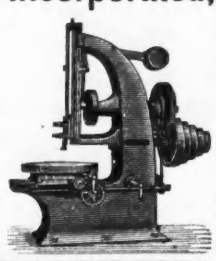

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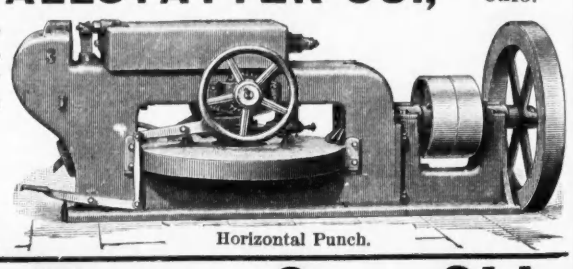

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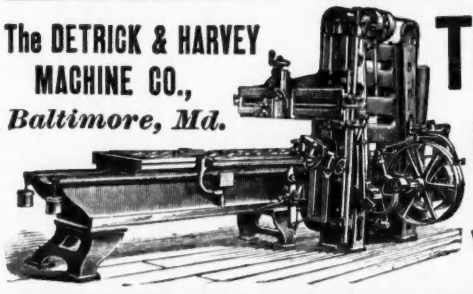

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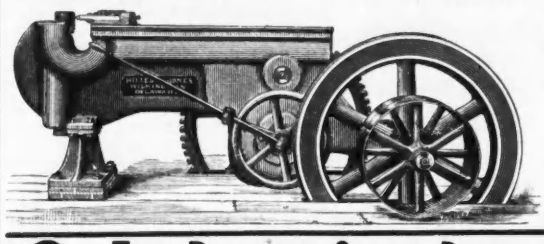

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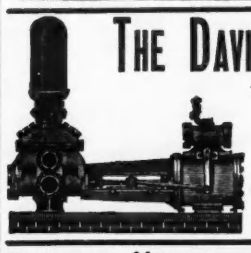

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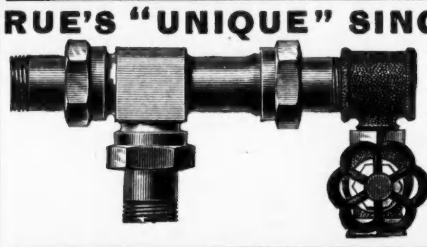

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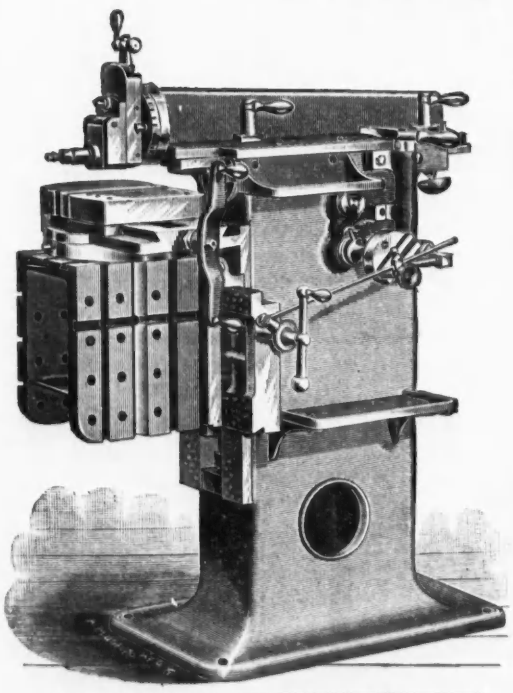

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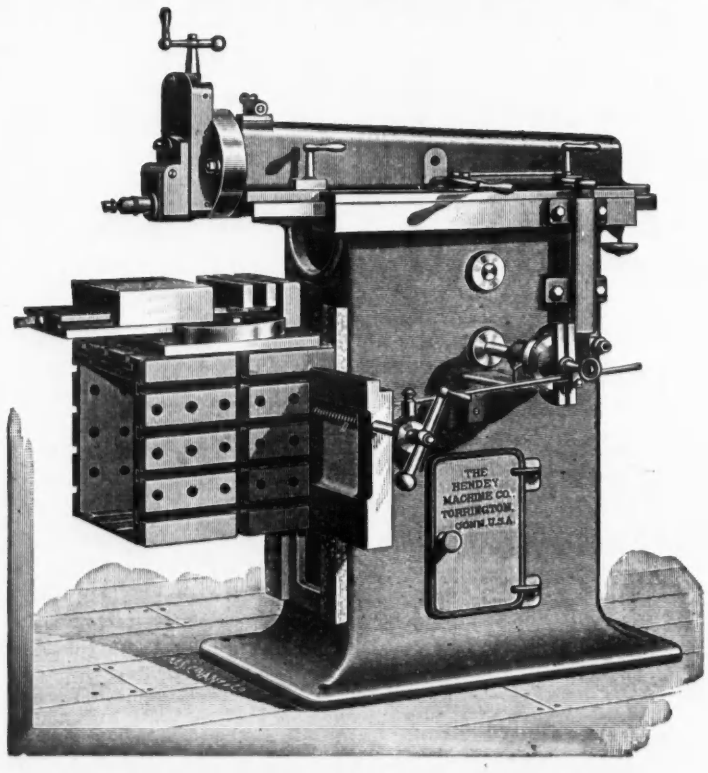

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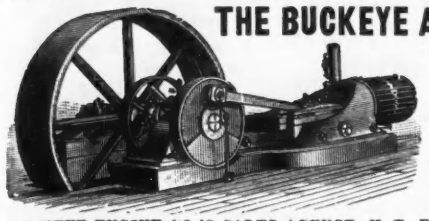

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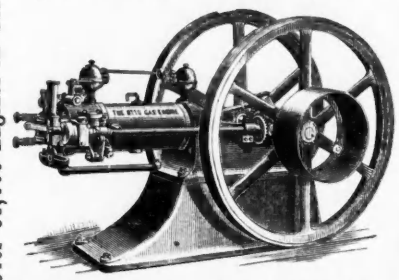

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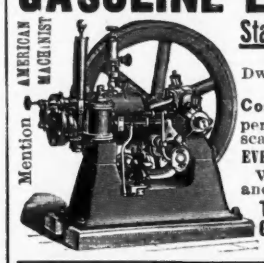

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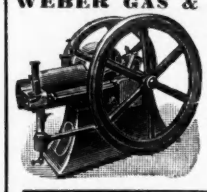

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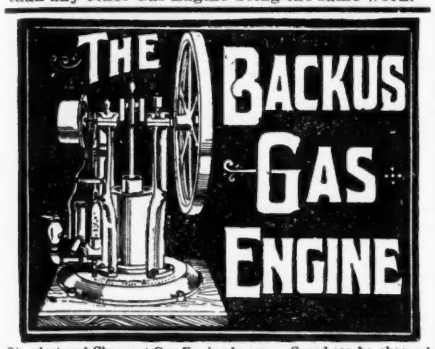

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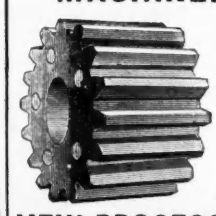

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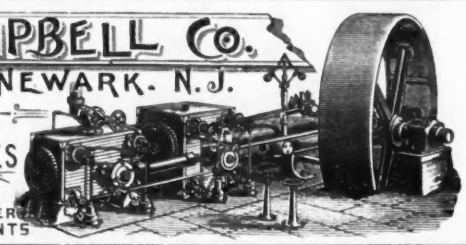

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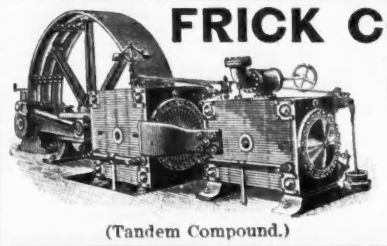

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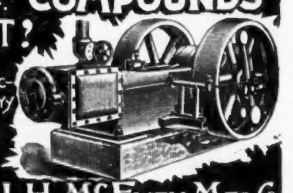

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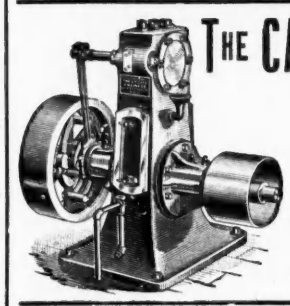

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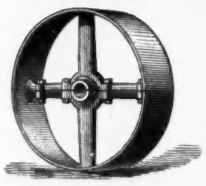

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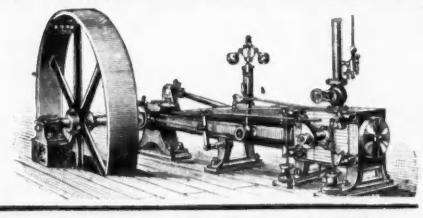

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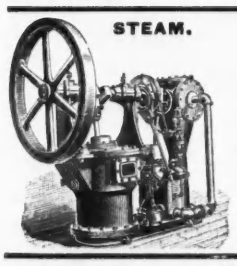

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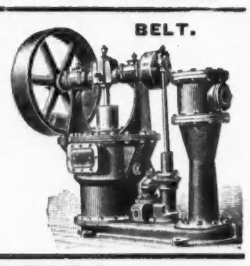

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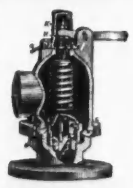

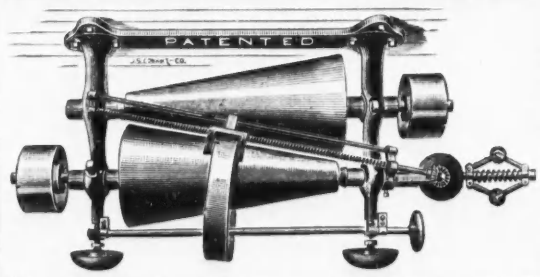

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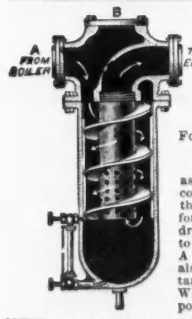

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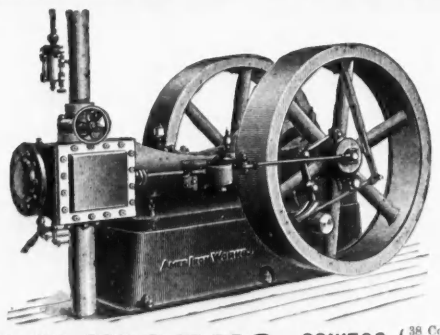

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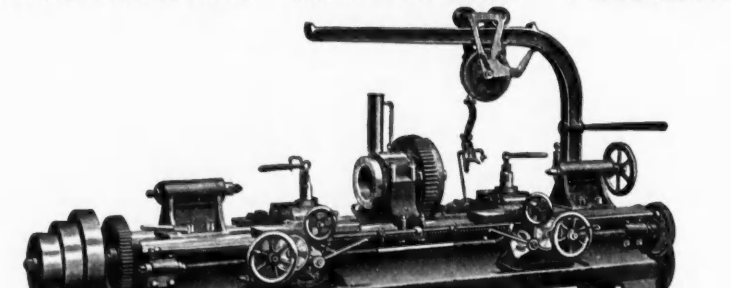

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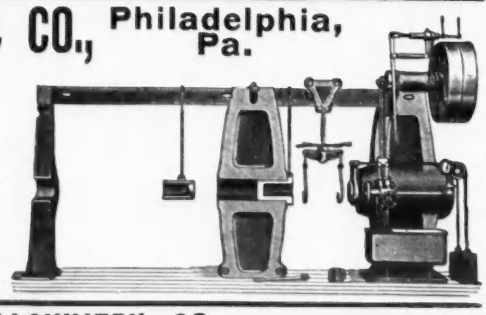

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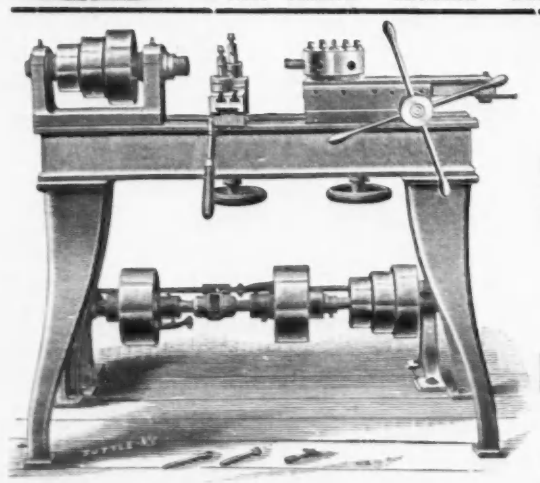

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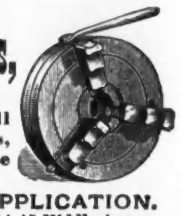

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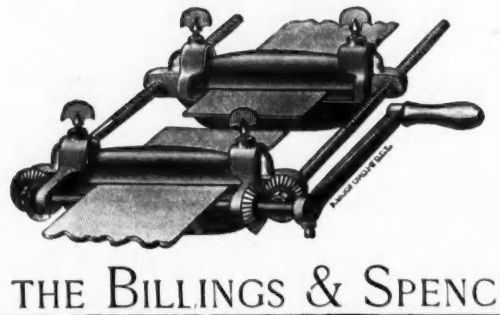

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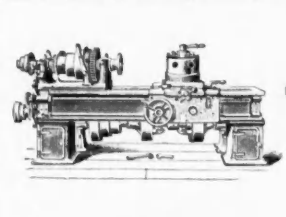

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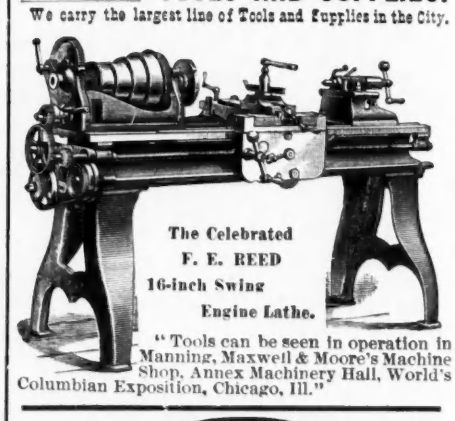

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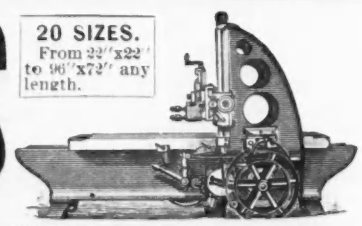

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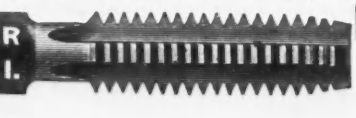

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